Precision Rotary Switches

CONTROL

shallcross

CATALOG
RS 100

shallcross

SUBSIDIARY OF **CUTLER-HAMMER**

SHALLCROSS MANUFACTURING COMPANY, SELMA, N.C.
ZIP CODE 27576 • TEL. 919 965-2341 • TWX 919 770-7839

THE SHALLCROSS LINE

PRECISION WIREWOUND RESISTORS

- Mil-R-93C Styles
- Hi Reliability Series
- Hi Precision Series
- Ceramic Bobbin Instrument Series
- Printed Circuit Series
- Subminiature Series
- Resistance Networks

ATTENUATORS

- Precision RF Attenuators
- Precision Audio Attenuators

PRECISION ROTARY SWITCHES

- Series 1 (1″) Rotary Switches
- Series 2 (1-3/4″) Rotary Switches
- Series 4 (2-1/2″) Rotary Switches
- 12,000 Series Oval Ceramic Switches
- Special Purpose Rotary Switches

INSTRUMENTS

- Resistance Decades
- Voltage Dividers
- Resistance Bridges
- Galvanometers
- Low Resistance Test Sets

INDEX

FOREWORD — Shallcross Series 1, 2 and 4 rotary switches constitute an unusually comprehensive and versatile rotary switch line. More importantly their overall quality and performance standards are unsurpassed (and in many areas unequalled) by any similarly classed standard switch group.

OTHER SHALLCROSS SWITCHES

Over 500 ceramic and phenolic instrument rotary switch types are described in bulletins L-31A and L-32. In addition, Shallcross has and will continue to design hundreds of special switches for high voltage, motor driven or other unique applications.

33 REASONS FOR SELECTING SHALLCROSS ROTARY SWITCHES

ELECTRICAL QUALITY

(1) Initial contact resistances measure less than two milliohms — variations of one milliohm or less typical during the life of the switch.

(2) Insulation resistances between circuits and ground exceed 10^{14} ohms under normal operating conditions.

(3) Thermal EMF ratings are less than 1 microvolt/°C.

(4) Arm and contact designs assure low noise generation during switching.

MECHANICAL QUALITY

(5) Precise and rugged detent mechanisms assure positive, long life detenting.

(6) Integral contacts and terminals provide terminal strength ratings in excess of all military and commercial standards.

(7) Rugged stop pin construction results in stop strength ratings beyond 50 in lbs.

(8) All materials are chosen for maximum reliability and electrical performance without cost compromises.

(9) Precision parts permit the mounting of up to 20 decks on a single shaft without misalignment during operation.

(10) Compact designs reduce back panel space requirements.

(11) All shafts are electrically isolated.

MILITARY RATINGS

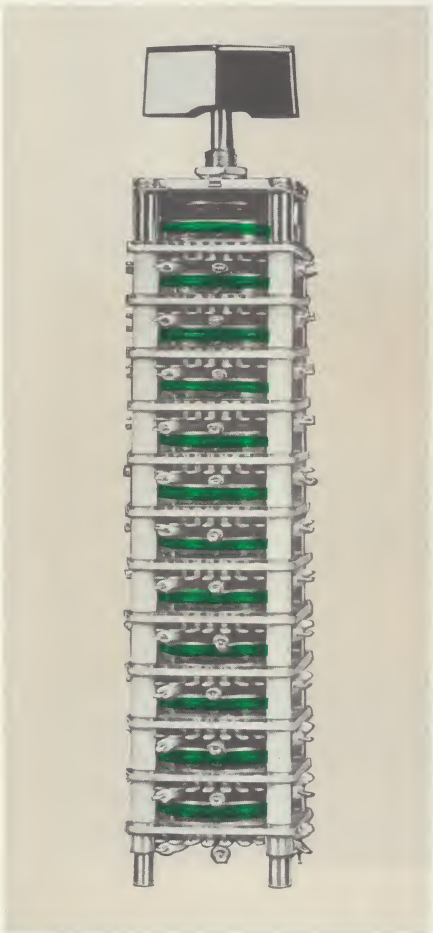
(12) Series 2 switches meet all requirements of MIL-S-3786 style SR14 (style SR14 encompasses standards that are more stringent than those presented by the general specification).

(13) Series 4 switches meet all requirements of MIL-S-3786 style SR15 (style SR15 encompasses standards that are more stringent than those presented by the general specification).

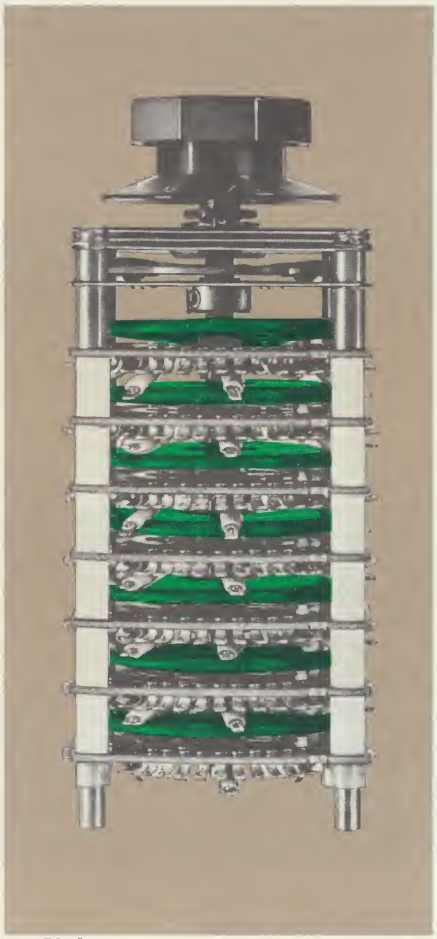
(14) Series 2 switches in conjunction with approved solenoid equipment meet all requirements of MIL-S-3786 style SR16.

FIELD TESTED

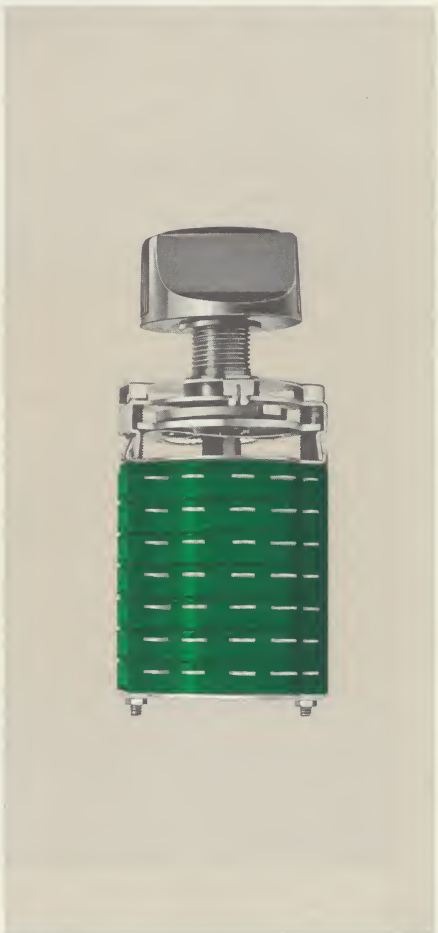
(15) Shallcross switches have been continuously refined as a result of the knowledge obtained from their field application in such space and



SERIES 2



SERIES 4



SERIES 1

missile programs as MINUTEMAN, POLARIS, SUBROC, TFX, and APPOLLO.

(16) Shallcross switches are consistently employed in commercial instrumentation requiring the best in rotary switching devices i.e., voltage comparator standards, precision resistance decades, precision digital ohmeters and voltmeters, etc.

VERSATILITY

(17) Series 1, 2 and 4 switches permit the selection of any number of positions per deck from 1-48 (shorting) or 1-24 (non-shorting) and 1, 2, 3 or 4 poles/deck.

(18) Adjustable stops permit field variation of positions/pole.

(19) Shorting and non-shorting switch decks can be combined on the same switch.

(20) Optional cluster arms provide progressive shorting or opening switching action.

(21) Dual concentric shaft option permits the independent switching of two switch groups from a single location (with a consequent reduction in space requirements).

(22) Most switches are readily available with solenoid drive.

(23) Spring return options provide spring return action in either or both directions from rest position.

(24) Standard dust covers are available for protection of arms, contacts and collector rings for many switch types.

(25) Optional gold plated current carrying parts are provided for corrosion protection if required.

CONVENIENCE

(26) Prewired switch assemblies available when preferred.

(27) Flared extended terminals promote wiring ease.

(28) Common and #1 positions are provided with easily identified markings.

(29) Storage protection is assured by "air tight" plastic packaging before shipment.

SPECIFICATION EASE

(30) Comprehensive part number systems permit the ordering of all standard switches and most options without drawings or formal specifications.

(31) Specification sheets when completed provide complete control drawings for customer records and permit easy specification of special or unique requirements.

COST

(32) Most Shallcross switches are priced below competitive switches in the same size and quality classification.

STOCK DELIVERY

(33) Standard Series 1, 2 and 4 switches (up to 3 decks) are available from stock at the following selected distributors:

Allied Electronics
100 North Western Avenue
Chicago, Illinois 60680

Forsberg Electronic Distributors
125 Perkins Avenue
Brockton, Massachusetts 02402

Westec Distributing Co.
504 Main Street
El Segundo, California

Samco Electronic Sales
P. O. Box 245
Fairview Village, Pennsylvania 19409

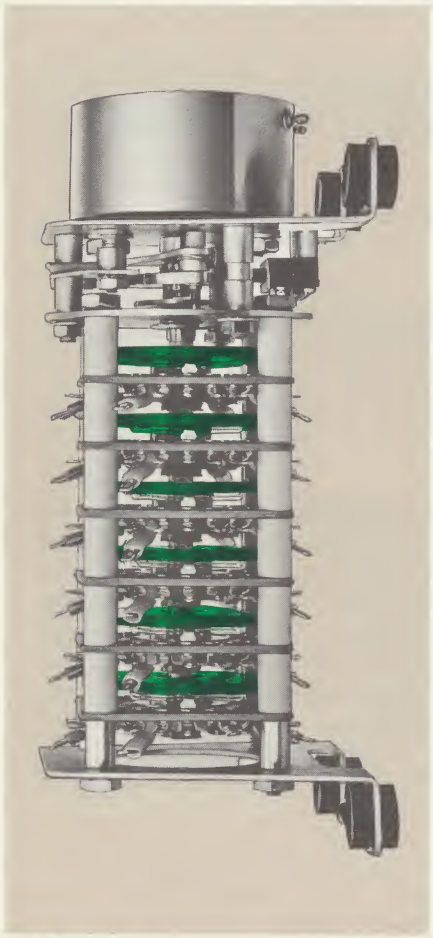
Taylor Electronics Corporation
2270 Grand Avenue
Baldwin, New York 11511

Fastronic
315 Reading Road
Reading, Ohio 45215

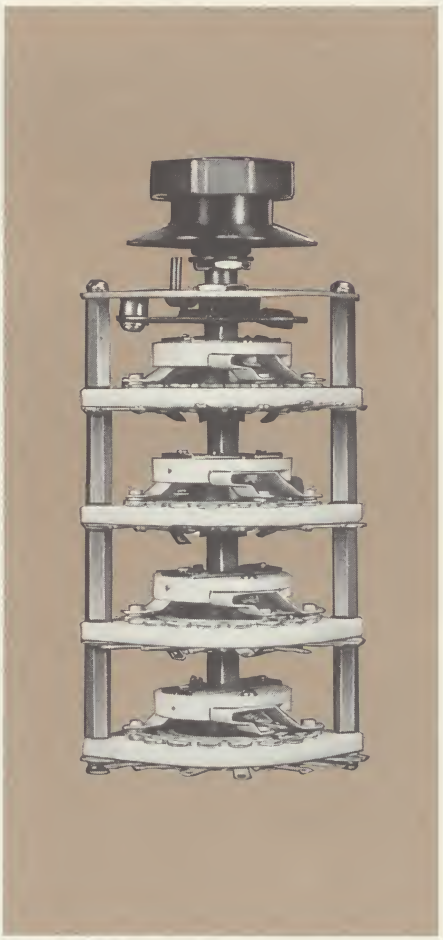
Southwest Electronics
3903-05 Richmond Avenue
Houston, Texas 77027

Beta Electronics, Inc.
P. O. Box 1001
Arlington, Texas

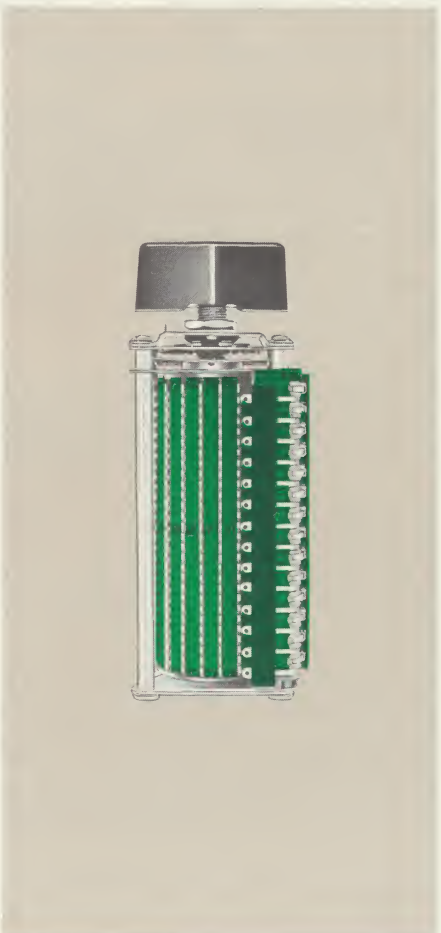
Production quantities are normally shipped in 2-3 weeks.



SOLENOID DRIVE



12000 SERIES



SPECIAL SWITCHES

FOREWORD — Shallcross SERIES 1 (1"), SERIES 2 (1¾"), and SERIES 4 (2½") precision rotary switches are designed to provide a versatile and comprehensive quality switch line that class for class offers peerless dry circuit and low signal level switching performance. Each exhibits exceptional mechanical reliability, positive detenting, very low and stable contact resistance, high insulation resistance, low switching noise, virtually immeasurable thermal EMF, high immunity to premature voltage breakdown, compactness, and environmental ratings in excess of any standards yet established by the military for switches in their class (MIL-S-3786, STYLES SR14, SR15 and SR16).
The specification of Shallcross switches is facilitated by a comprehensive part number system and/or easily completed specification sheets for each switch group. Selection of the correct switch type will be aided by consulting the basic design considerations described below.

DESIGN CONSIDERATIONS

ELECTRICAL DESIGN CONSIDERATIONS:

SHORTING OR NONSHORTING — Shorting switching action provides a MAKE BEFORE BREAK circuit and nonshorting a BREAK BEFORE MAKE circuit. SERIES 2 and SERIES 4 switches use every other contact for nonshorting action and the available positions/pole are halved as a result. Contacts on SERIES 2 and 4 nonshorting switches can be strapped in pairs to realize shorting action if both shorting and nonshorting action are required on the same deck or switch.

TOTAL NUMBER OF POLES AND POSITIONS/POLE — The number of positions/pole and the total number of poles required are the principal controlling factors in determining the appropriate switch series (or switch size) and number of decks. Generally the switch type selected should provide the total number of poles, and positions/pole required on a minimum number of decks to reduce the back panel depth and cost. The switch size, positions/pole, indexing angle, and switching action (shorting or nonshorting) are the controlling factors in determining the maximum poles/deck. If more than one switch series can supply the desired switching action with an identical number of decks, then the smallest switch type with its lower cost is normally preferable. (Make certain the smaller switch has adequate electrical ratings and can physically accommodate all "wired on" components.)

LIFE VS LOAD RATINGS — Appropriate life cycle ratings are supplied for each switch group under a number of different load (breaking) conditions. The switch type selected should satisfactorily meet your contact resistance and life requirements when subjected to the load conditions dictated by your application.

CONTACT RESISTANCE — Shallcross contact resistance ratings establish the maximum input to output resistance presented by the switch at any position. Variations in contact resistance are contingent upon load conditions, environment and frequency of switch operation. Typical variations under various loads are supplied in the ratings for each switch group.

VOLTAGE BREAKDOWN — During operation most rotary switches will experience a reduction in the voltage breakdown point due to metal particle and carbon deposit buildups between switch contacts. "End of life" and initial ratings are supplied to insure proper specification.

CAPACITANCE — Switch capacitance, stator dielectric characteristics and the nature of the circuit to be switched are among the factors determining rotary switch frequency limitations. Capacitance ratings are supplied but the factory should be consulted when the switching of high frequency signals is contemplated.

MECHANICAL CONSIDERATIONS:

DIMENSIONS — Exact back panel depths and overall dimensions are provided for all switch types. Consideration should be given to the additional space required for wiring, "wired on" components and rear mounting supports.

MOUNTING — (1) Single hole bushing (2) two hole or (3) bushing and two hole mounting configurations are available options for most Shallcross switches. Optional bushing lengths are provided for all bushing mounting types to assure custom mounting to a wide range of panel thicknesses. Two hole mounting methods are preferable for switches with high rotational torque ratings. Rear mounting supports are recommended (a MIL-S-3786 requirement) for switches having over 5 wafers (SERIES 2), 4 wafers (SERIES 4) and 9 wafers (SERIES 1).

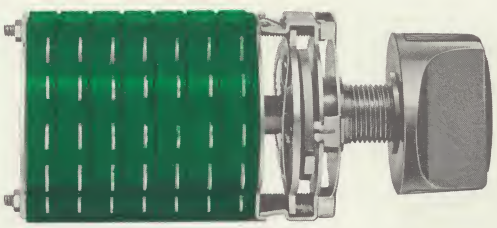
ROTATIONAL TORQUE — An increase in the total poles/switch and/or decks/switch will present a nearly proportionate increase in the torque required for switch rotation. Two hole mounting, rear mounting supports and larger sized knobs mounted on flatted shafts are recommended for switches having an extended number of poles or decks. (Consult the rotational torque specifications for each switch group.)

FLATTED SHAFTS — Certain knob types and switches with high rotational torque characteristics dictate the use of single or double flatted shafts. Flat angles must be specified.

SPECIAL SHAFT LENGTHS — Shaft lengths other than the standard 1" length must be specified when required.

MILITARY CONSIDERATIONS: SPECIFICATION— MIL-S3786, STYLES SR14, SR15 or SR16 requirements must reference that standard on all drawings and/or purchase orders to assure shipment of switches with the correct markings and mounting dimensions.

SPECIAL CONSIDERATIONS: One or more of the following options may be beneficial or required for your application and should be evaluated. (1) PREWIRED TERMINALS, (2) GOLD PLATED CURRENT CARRYING PARTS, (3) CLUSTER ARMS for progressive shorting or opening switching action, (4) DUAL CONCENTRIC SHAFT for reducing panel space requirements, (5) DUST COVERS, (6) SOLENOID DRIVE, (7) PRINTED CIRCUIT MOUNTING TERMINALS, (8) SPRING RETURN DETENT ACTION. These options are described in this catalog.



NEW

A ONE INCH PRECISION ROTARY SWITCH LINE THAT ESTABLISHES THE HIGHEST ELECTRO-MECHANICAL PERFORMANCE STANDARDS IN ITS SIZE CLASSIFICATION

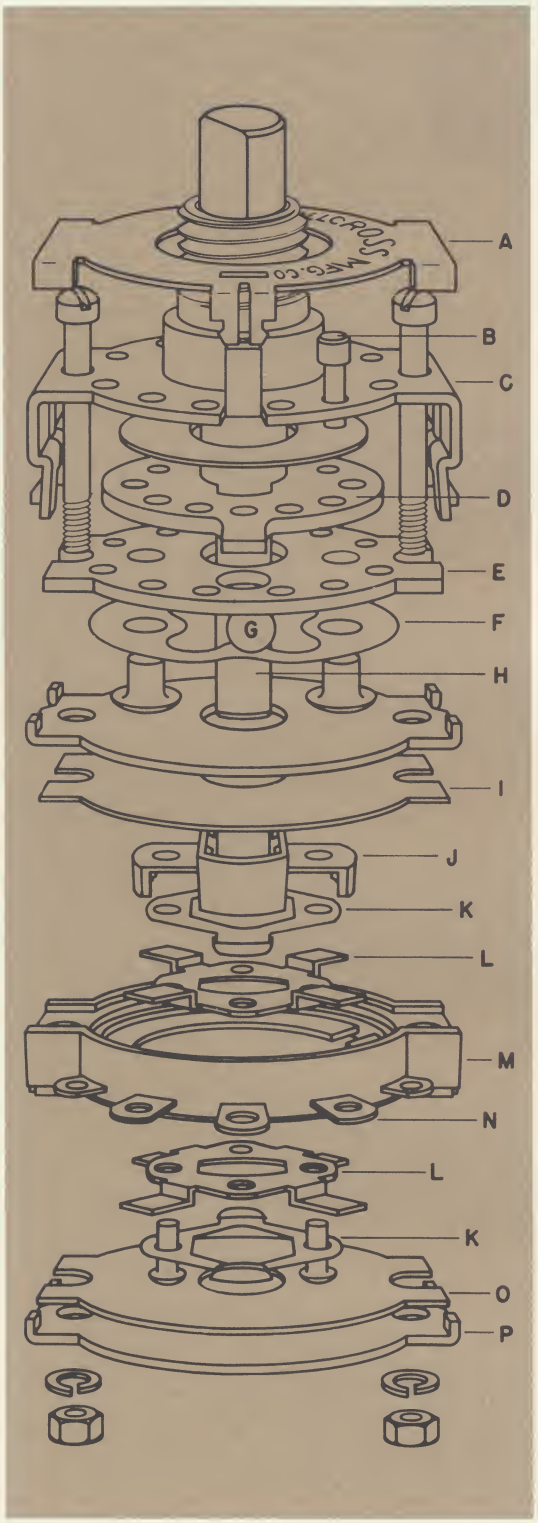
Shallcross SERIES 1 switches incorporate the highest electro-mechanical performance standards yet introduced to the one inch rotary switch classification. Specific performance improvements include: superior contact resistance vs load vs life ratings; unsurpassed electro-mechanical reliability during rated life; improved voltage breakdown characteristics; lower switching noise; lower thermal EMF and higher insulation resistance ratings.

SERIES 1 switches exceed in performance the requirements of Mil-S-3786 (Style SR04) and the most stringent standards presented by commercial instrumentation for switches in this classification. Conservative, definitive ratings are combined with design sophistication, unequalled materials quality and 100% quality control inspection to assure maximum operational reliability.

Ease of procurement and specification are encouraged by reproducible specification sheets, a comprehensive order code system and stock delivery from any of six selected distributors.

The logic of selecting Shallcross SERIES 1 switches for your application can best be confirmed by an objective, comparative evaluation with competitive counterparts.

SHALLCROSS SERIES 1 MECHANICAL DETAILS



CHECK THESE FEATURES

(1) EXCEPTIONALLY POSITIVE, LONG LIFE INDEXING is provided by captive dual balanced balls (G) riding a coined socket detent plate (D); all passivated stainless steel construction; and a special lubricant at all frictional surfaces.

(2) SUPERIOR CONTACT RESISTANCE VS LOAD VS LIFE RATINGS result from dual, balanced, independently sprung, silver alloy moving contacts (K) "making" each silver alloy stationary contact. The dual moving contacts provide redundant contact surfaces as well as reduced axial stress on the rotor for enhanced operational reliability.

(3) IMPROVED CONTACT RESISTANCE AND VOLTAGE BREAKDOWN CHARACTERISTICS result from a "breaking action" that reduces "cross tracking" between contact and insulation materials.

(4) MOVING CONTACT ALIGNMENT IS INDEPENDENT OF SHAFT AXIAL "PLAY" to reduce the possibility of accidental arm damage.

(5) RUGGED, EXTENDED TERMINALS (N) are integral with stationary contacts to minimize structural failures. A choice of two standard terminal locations for multiwafer switches provides added wiring flexibility and ease (terminals may be located over the entire circumference of the switch or in a 180° arc at your option).

(6) EXCEPTIONAL STOP STRENGTH is assured by the use of rugged stainless steel stops (B) stop pin supports (C and E) and stop arm (D).

(7) DIALLYL PHTHALATE, MODULAR STATORS (M) are keyed and nested for positive, accurate deck alignment (enclosed construction also provides dust protection for switch internal parts).

(8) MOLDED IN TERMINALS eliminate resin "in-flow" on contacts during lead soldering.

(9) EASILY ADJUSTED STOPS (B) permit field setting of positions/pole. "Snap off" plate (A) provides ready access to stops.

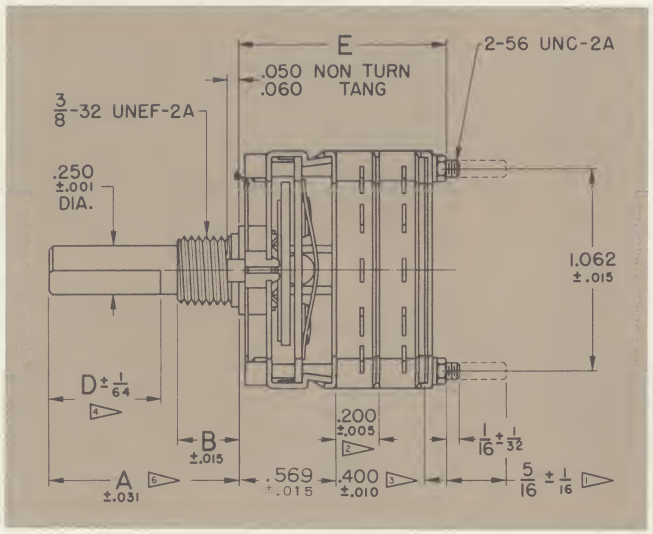
(10) POSITIVE SHORTING OR NONSHORTING ACTION is assured by rugged contacts with close tolerance dimensions, spacing, and alignment.

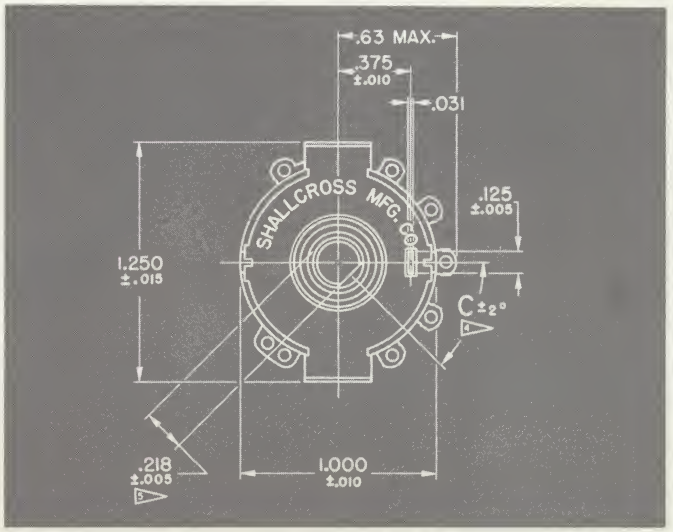
(11) TERMINAL LOCATIONS ARE IDENTIFIED on rear cover plate (P).

(12) LOW THERMAL EMF CHARACTERISTICS result from the use of similar metals for all current carrying parts.

(13) REDUCED SWITCHING NOISE AND CONTACT BOUNCE are assured by dual, smooth riding, button type, moving contacts — Low contact resistances also contribute to improved switching noise characteristics.

SHALLCROSS | SERIES 1 | DIMENSIONS AND MATERIALS





1. Add on dimension to provide rear support accommodations for 10 or more wafers only.
2. See back panel dimension chart for wafers/pole and exact back panel dimension per switch type.
3. See back of panel dimension chart for wafers/pole and exact back panel dimension per switch type.
4. Flatted shafts not supplied unless specfied.
5. Flatted shafts when specified will be cut to the standard dimension shown (optional dimensions available).

BACK OF PANEL DIMENSION "E" VS. TOTAL NO. OF POLES

	TOTAL NUMBER OF POLES	TOTAL NUMBER OF WAFERS	MAXIMUM OVERALL LENGTH (Inches)	NOMINAL OVERALL LENGTH (Inches)	NOMINAL OVERALL LENGTH TOL. (± Ins.)	
SWITCH TYPES IJ04 IJ06 IJ54 IJ56 (2-6 positions per pole)	1	1	.895			Without rear support
	2	2	1.100			
	3	3	1.305			
	4	4	1.510			
	5	5	1.715			
	6	6	1.920			
	7	7	2.125			
	8	8	2.330			
	9	9	2.535			
	10	10	2.740			
	11	11	To obtain maximum overall length add tolerance to nominal	2.865	.080	With rear support
	12	12		3.065	.085	
	13	13		3.265	.090	
	14	14		3.465	.095	
	15	15		3.665	.100	
SWITCH TYPES IJ00 IJ02 IJ50 IJ52 (2-12 positions per pole)	1	2	1.100			Without rear support
	2	4	1.510			
	3	6	1.920			
	4	8	2.330			
	5	10	2.740			
	6	12	To obtain maximum overall length add tolerance to nominal	3.065	.085	With rear support
	7	14		3.465	.095	
	8	16		3.865	.105	
	9	18		4.265	.115	
	10	20		4.665	.125	

SHAFT LENGTHS (DIM. A)

Shaft lengths are measured from end of shaft to mounting surface. Standard shaft length is one inch ± .015 . Optional shaft lengths from 5/8" to 2" are available. Shallcross code numbers for optional shaft lengths are as follows:

SHAFT LENGTH	5/8	3/4	7/8	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2
SHALLX CODE	05	06	07	11	12	13	14	15	16	20

STANDARD MTG. BUSHING LENGTHS

SHALLX TYPE	A	C	D	E
BUSHING LENGTH (DIM. B)	5/16	1/2	3/8	3/4

MATERIALS

STOP RETAINER, MTG. PLATE, DETENT PARTS, COVER PLATE WASHERS, STOP PIN, SCREWS, NUTS, SHAFT, ROTOR GUIDE — stainless steel (passivated)
CONTACT ARMS — Beryllium copper (silver plated)
ROTOR CONTACTS (MOVING), STATOR CONTACTS (STATIONARY) AND INTEGRAL TERMINALS — silver alloy
ROTOR INSULATOR — Lexan
STATOR — Diallyl Phthalate (glass filled)

SHALLCROSS SERIES 1 RATINGS (COMMERCIAL)

LOAD-LIFE RATING METHODS

All commercial load-life ratings were obtained from tests made under normal room conditions. One life cycle consisted of one full rotation both clockwise and counterclockwise.

The following criteria were established as a failure definition:

1. MAXIMUM ALLOWABLE CONTACT RESISTANCE

.0045 Ω	15 VOLT AMPERES
.0055 Ω	25 VOLT AMPERES
.006 Ω	30 VOLT AMPERES

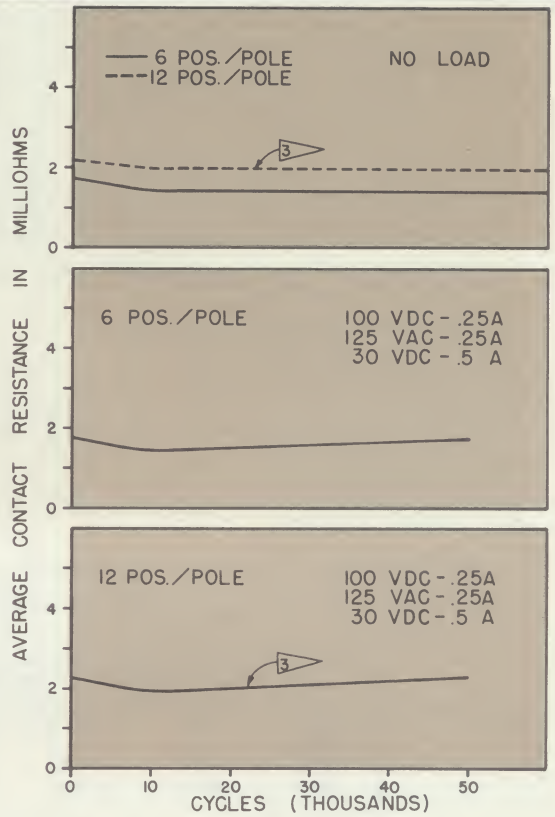
2. MINIMUM ALLOWABLE VOLTAGE BREAKDOWN — 800 volts RMS (between any two active positions or to ground).

3. MINIMUM ALLOWABLE INSULATION RESISTANCE — 10^{10} ohms (between any two active positions or to ground).

4. MECHANICAL FAILURE — rotational failure, arm misalignment, contact misalignment, etc. (Electrical failure preceded mechanical failure for every sample tested).

LOAD (BREAKING) VS. LIFE (CYCLES)	
LOAD	LIFE
NO LOAD	50,000
100VDC-.25A	50,000
125VAC-.25A	50,000
30VDC-.5A	50,000

CONTACT RESISTANCE VS LOAD VS LIFE



3 ON TYPES 02 & 52 CONTACT RESISTANCE IS MEASURED TO COMMON TERMINAL ON WAFER ADJACENT TO SELECTOR CONTACT. WIRE BETWEEN COMMON TERMINALS .0017 OHMS.

CURRENT CARRYING CAPACITY

10 AMPS (FOR TEMPERATURE RISE < 30°C)

VOLTAGE BREAKDOWN

(—55°C TO +85°C, 50% RH, SEA LEVEL)

	INITIAL (MINIMUM)	END OF LIFE (MINIMUM)
BETWEEN POLES	2000 V RMS (60 CYCLES)	1500 RMS (60 CYCLES)
BETWEEN CONTACTS	1000 V RMS (60 CYCLES)	800 RMS (60 CYCLES)
TO GROUND	2000 V RMS (60 CYCLES)	1500 RMS (60 CYCLES)

INSULATION RESISTANCE (room conditions)

INITIAL > 10^{12}

END OF LIFE > 10^{10}

THERMAL EMF

1 μ VOLT /°C (MAXIMUM)

TEMPERATURE RANGE

—40°C to +85°C

CONTACT RESISTANCE

INITIAL — 6 POS/POLE —.0025 Ω MAX.
12 POS/POLE —.0035 Ω MAX.

VARIATION — SEE CHARTS

TERMINAL STRENGTH

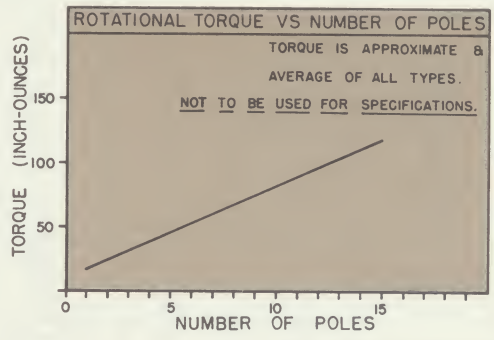
WITHSTAND 5 LB PULL THREE MUTUALLY PERPENDICULAR PLANES

STOP STRENGTH

WITHSTAND 25 IN/LB ROTATIONAL FORCE

CAPACITANCE

POINTS OF MEASUREMENT	CAPACITANCE
BETWEEN ADJACENT ACTIVE CONTACTS	.5 uuf MAXIMUM
BETWEEN CONTACT AND COMMON TERMINAL	.9 uuf MAXIMUM
BETWEEN COMMON AND FRAME	10.0 uuf MAXIMUM
BETWEEN POLES	5.0 uuf MAXIMUM



SHALLCROSS SERIES 1 SHORTING SWITCHES

INDEXING ANGLE — All Series 1 switch types (whether shorting or nonshorting) have 30° indexing.

CONTINUOUS ROTATION — Continuous rotation operation is supplied standard only when 12 positions/pole are specified (adjustable stops are packaged separately). Six position/pole switches are provided with stops set by the factory, however, they may be converted to continuous rotation in the field by simply removing the stops. (Note that 6 position/pole switch types have 30° indexing and consequently each position will be "made" twice during a 360° rotation of the switch shaft.)

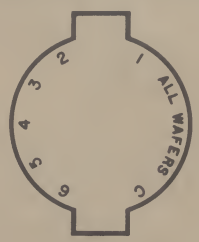
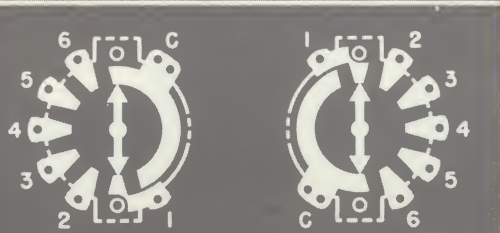
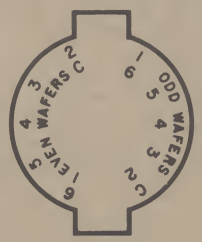
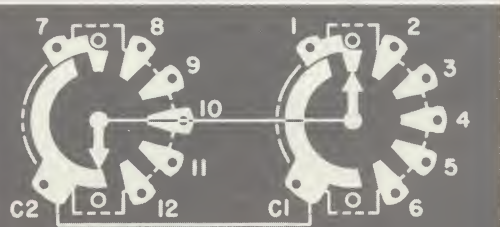
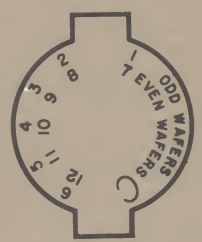
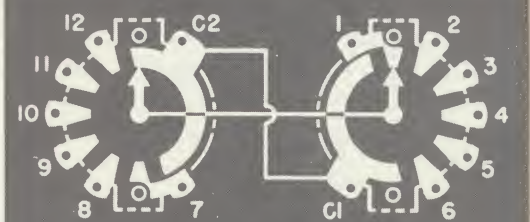
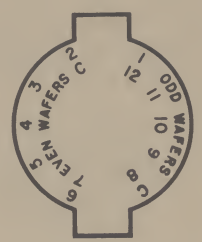
IMPORTANT

The unique design of Series one switches necessitates a slight departure from conventional practice in determining the total number of wafers required to obtain a given number of poles. Note that switch types with 7-12 positions/pole use **two wafers for each pole** to obtain the total positions available (positions 1-6 are located on odd numbered wafers and positions 7-12 on even numbered wafers). Switch types with 1-6 available positions/pole use one wafer for each pole.

SETTING OF POSITIONS/POLE — Stops will be set by the factory for the positions/pole ordered excepting 12 positions/pole types which will be supplied with continuous rotation (stops are packaged separately). Stops can be easily relocated in the field to alter the positions/pole when required.

CONNECTING COMMONS — The factory will make any common or internal connections required to obtain the switching configuration assigned to each Series 1 switch type.

SERIES 1 SHORTING SWITCHES

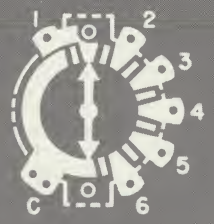
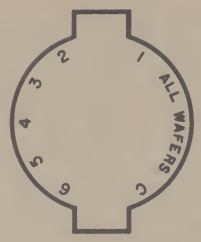
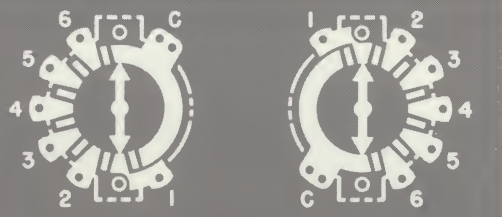
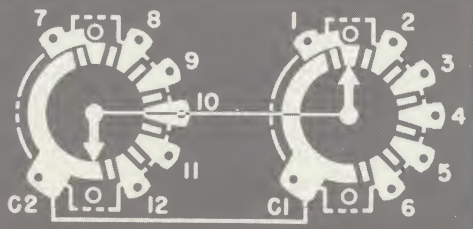
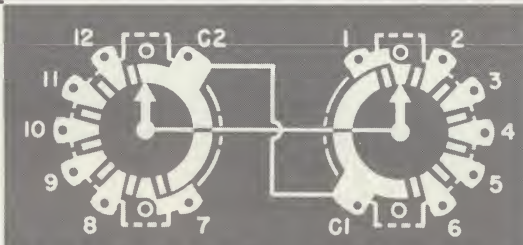
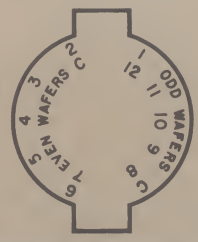
SHALLCROSS SERIES	POSITIONS PER POLE	WAFERS PER POLE	MAX. TOTAL POLES	TERMINAL LOCATIONS AND WAFER CONFIGURATIONS VIEWED FROM MTG. PLATE WITH MOVING CONTACT IN #1 POSITION AND MTG. TANG AT 90° (3 O'CLOCK)	REAR COVER PLATE WITH TERMINAL LOCATION MARKINGS FOR EACH SWITCH TYPE
1J04	2-6	1	20		
1J06	Type IJ06 is identical to type IJ04 except alternate wafers are rotated 180° to provide an optional terminal location arrangement (see wafer configuration drawings for these 2 types).				
1J00	2-12	2	10		
1J02	Type IJ02 is identical to type IJ00 except alternate wafers are rotated 180° to provide an optional terminal location arrangement (See wafer configuration drawings for these 2 types).				

Lines between arrows show internal connection between rotor contacts. They are not connected to stator contacts.

ORDER CODE AND NON-SHORTING TYPES NEXT PAGE.

SHALLCROSS SERIES 1 NONSHORTING SWITCHES

SERIES 1 NONSHORTING SWITCHES

SHALLCROSS SERIES	POSITIONS PER POLE	WAFERS PER POLE	MAX. TOTAL POLES	TERMINAL LOCATIONS AND WAFER CONFIGURATIONS VIEWED FROM MTG. PLATE WITH MOVING CONTACT IN #1 POSITION AND MTG. TANG AT 90° (3 O'CLOCK)	REAR COVER PLATE WITH TERMINAL LOCATION MARKINGS FOR EACH SWITCH TYPE
1J54	2-6	1	20	 EVEN AND ODD WAFERS	
1J56	Type IJ56 is identical to type IJ54 (above) except alternate wafers are rotated 180° to provide an optional terminal location arrangement (see wafer configuration drawings for these 2 types).			 EVEN WAFERS ODD WAFERS	
1J50	2-12	2	10	 EVEN WAFERS ODD WAFERS	
1J52	Type IJ52 is identical to type IJ50 (above) except alternate wafers are rotated 180° to provide an optional terminal location arrangement (see wafer configuration drawings for these 2 types).			 EVEN WAFERS ODD WAFERS	

Lines between arrows show internal connection between rotor contacts. They are not connected to stator contacts.

SERIES 1 ORDER CODE

I	J	50	A	12	—	4	—	K	12	M
SERIES ONE	INDEX ANGLE	WAFER CONFIGURATION	SHALLCROSS MOUNTING TYPE	POSITIONS PER POLE	DASH	TOTAL NUMBER OF POLES	DASH	GOLD PLATING	OPTIONAL SHAFT LENGTH	CUSTOMER MARKING
	SELECT WAFER CONFIGURATION THAT PROVIDES PREFERRED SWITCHING ACTION (SHORTING OR NONSHORTING) MAX. POS/POLE AND TERMINAL LOCATIONS		SELECT FROM AVAILABLE BUSHING LENGTHS CHART	NUMBER OF POSITIONS PER POLE AND TOTAL NUMBER OF POLES ARE NOT TO EXCEED THE MAXIMUM AVAILABLE FOR SWITCH TYPE ORDERED				ADD LETTER K IF GOLD PLATED CURRENT CARRYING PARTS ARE REQUIRED	FOR LENGTHS OTHER THAN STANDARD 1" ADD APPROPRIATE CODE FROM SHAFT LENGTH CHART	ADD LETTER M IF YOUR PART NUMBER IS TO BE MARKED ON MOUNTING PLATE
								STANDARD OPTION CODE		
								OMIT CODE NUMBERS FOR OPTIONS NOT REQUIRED		

SPECIFICATION SHEETS

Series 1 Specification Sheet #5 can be used to conveniently create your own control drawings when required. See pages 24 and 25.

THE INDUSTRIES' TOP VALUE 1¾" QUALITY ROTARY SWITCH LINE (cost vs electromechanical performance and reliability)

MEET THE REQUIREMENTS OF MIL-S-3786 styles SR14-1 and SR14-2

EXCEPTIONAL CONTACT RESISTANCE VS. LOAD VS LIFE RATINGS

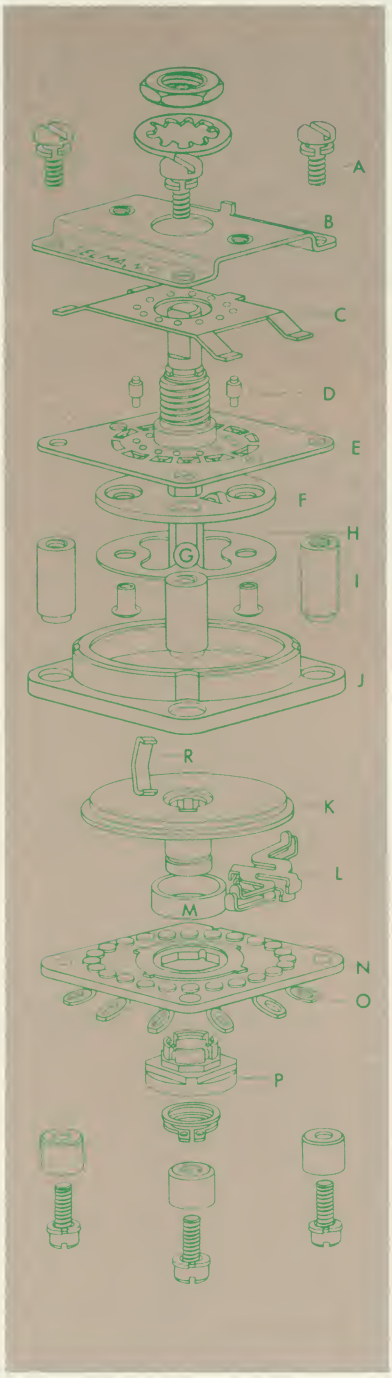
FEATURES

RUGGED STOPS, SWITCH DECKS, DETENTS AND TERMINALS (easily wired)

24 OR 32-POSITIVE DECKS AND UP TO 20 POLES/SWITCH

CONSERVATIVE, DEFINITIVE RATINGS THAT REFLECT OUTSTANDING ELECTROMECHANICAL PERFORMANCE

MECHANICAL DETAILS



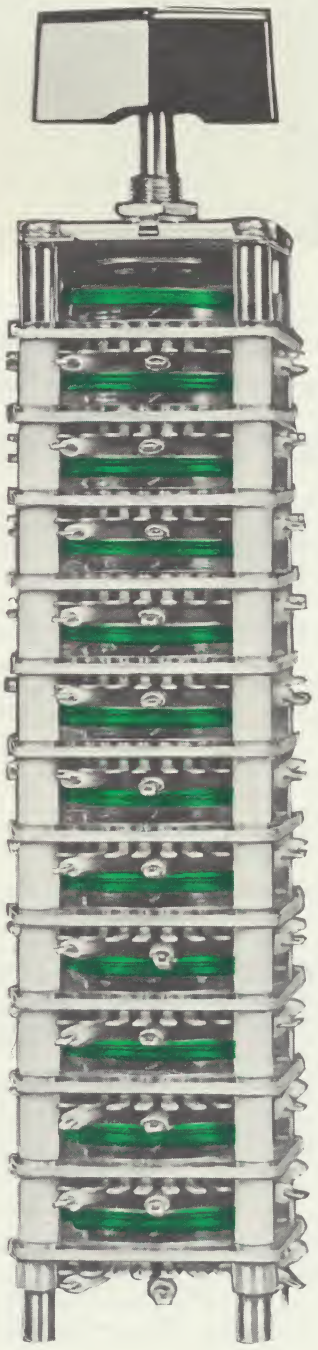
ADJUSTABLE STOPS— Stops are set at the factory to provide the number of positions ordered. Continuous rotation switches (single pole/deck only) are supplied with separate stops in their shipping containers. To alter the number of positions available per pole, turn the shaft completely CCW, remove mounting plate screws (A), mounting plate (B), stop pin retainer (C), and relocate one stop pin (D) to provide the total rotation required. The stop pin adjacent to the lanced finger on ball retainer plate (F) remains fixed. Make certain that stop pin retainers (C) and mounting plate (B) are reassembled in their original positions (retainer is keyed to mounting plate tang hole which in turn must be located on the same side of switch as identification notch on switch deck). On multiple/deck switches do not locate stops beyond the maximum positions/pole available for that switch type and do not rotate the shaft until the switch has been reassembled.

DETENT ASSEMBLY— Balanced dual captive balls (G) riding a hill and dale type detent plate (E) are retained by plate (F) and spring (H). The special ball, detent plate, and ball retainer plate configurations plus precision tolerance parts, provide exceptionally positive and durable detenting when compared to conventional designs.

DUST COVER (Optional)— Translucent plastic dust cover (J) is available for the dust protection of all switch contact, contact arm, and collector segment contact surfaces. The addition of these covers does not alter the back panel or OD dimensions of the standard switch (special rotors and deck spacers (I) are provided to maintain these dimensions).

ARMS AND ROTORS— Dual, silver contact arms (L) with completely independent spring members, canted contacting surfaces, and rotor attachments provide exceptionally low contact resistance. The unique arm configuration also provides self-wiping action and constant tension on all contacts to assure contact resistance stability. The plastic (diallyl phthalate) rotors (K) accept up to 4 contact arm sets to provide 1, 2, 3 or 4 pole/deck operation as required.

DECK ASSEMBLY— Silver contacts with special shanks staked into a glass fibre reinforced epoxy stator (N) are flatted, pierced and flared to provide integral terminal lugs and contacts (O) for minimum contact to terminal resistance and maximum reliability. Silver collector rings are staked to the stator and soldered directly to the common terminals to reduce the number of connection points. "Pressed in" nylon bushings (P) and rotor spacers (M) positively position the rotor and reduce frictional drag. A rotor spring (R) between the shaft and rotor locks them together to eliminate backlash during rotation.



MECHANICAL DETAILS CONT. ON PAGE 14

SHALLCROSS SERIES 2 DIMENSIONS AND MECHANICAL SPECIFICATIONS

TYPES A, C, D AND E BUSHING MTG. (ACTUAL SIZE)

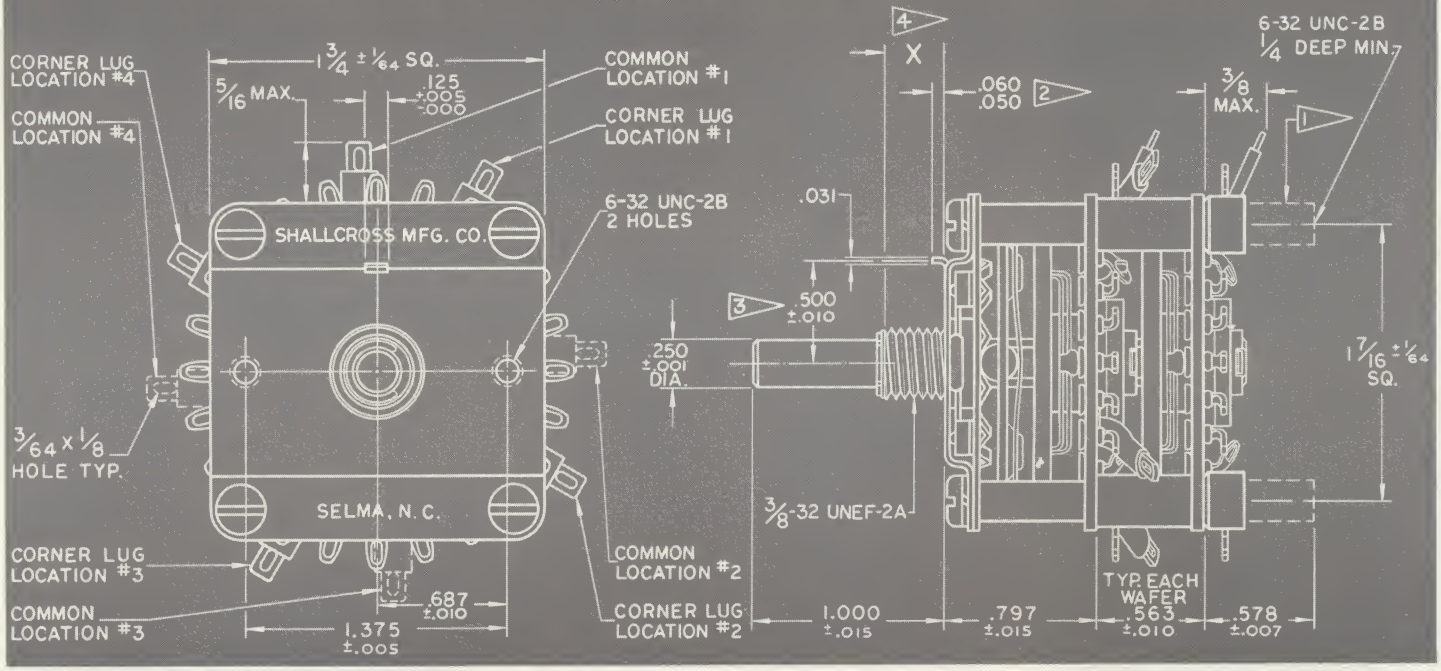


DIAGRAM 1

DIAGRAM 2

1. Rear support spacers supplied on 6 decks or more. Standard tang length as shown.(.120/.110 tang length available.)
2. Standard tang location as shown.(.531" dimension optional with .050/.060 tang length.)
3. See standard mtg. bushing lengths chart below for available bushing sizes.

COMMON AND CORNER TERMINAL LOCATIONS

SWITCH TYPE		TERMINAL LOCATIONS FROM DIAGRAM 1	
		COMMON TERMINALS	CORNER TERMINALS
1 POLE PER DECK	2J50	#1	NONE
	2J00	#1	ALL FOUR
	2H50	#1	NONE
	2H00	#1	ALL FOUR
	2E00	#1	ALL FOUR
	2C00	#1	ALL FOUR
2 POLES PER DECK	2J56	#1 & #3	NONE
	2J06	#1 & #3	#1 & #3
	2H56	#1 & #3	NONE
	2H06	#1 & #3	#1 & #3
	2E06	#1 & #3	#1 & #3
	2C06	#1 & #3	#1 & #3
3 POLES PER DECK	2J62	#1, #2 & #3	NONE
	2J12	#1, #2 & #3	NONE
	2H62	#1, #2 & #3	NONE
	2H12	#1, #2 & #3	NONE
	2E12	#1, #2 & #3	NONE
	2C12	#1, #2 & #3	NONE
4 POLES PER DECK	2J68	ALL FOUR	NONE
	2J18	ALL FOUR	NONE
	2H68	ALL FOUR	NONE
	2H18	ALL FOUR	NONE
	2E18	ALL FOUR	NONE
	2C18	ALL FOUR	NONE

DECK CONFIGURATION DRAWINGS FOR ALL SHALLCROSS SERIES 2 SWITCH TYPES ON PAGES 19-20-21

STANDARD MTG. BUSHING LENGTHS

SHALLX TYPE	BUSHING LENGTH (DIM.X)
A	5/16"
B	NO BUSHING
C	1/2"
D	3/8"
E	3/4"

ALL BUSHINGS ARE 3/8—32 UNEF—2A

SHAFT LENGTHS

Shaft lengths are measured from end of shaft to mounting surface. Standard shaft length is one inch ± .015 . Optional shaft lengths from 5/8" to 2" are available. Shallcross code numbers for optional shaft lengths are as follows:

SHAFT LENGTH	5/8	3/4	7/8	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2
SHALLX CODE	05	06	07	11	12	13	14	15	16	20

TYPE B 2 HOLE MTG. (ACTUAL SIZE)

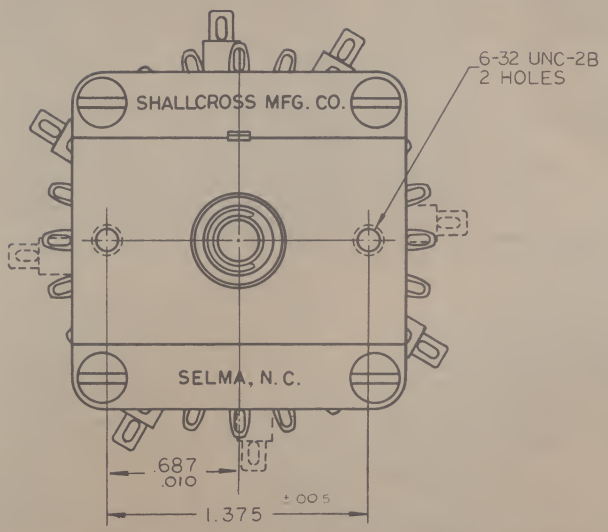


DIAGRAM 3

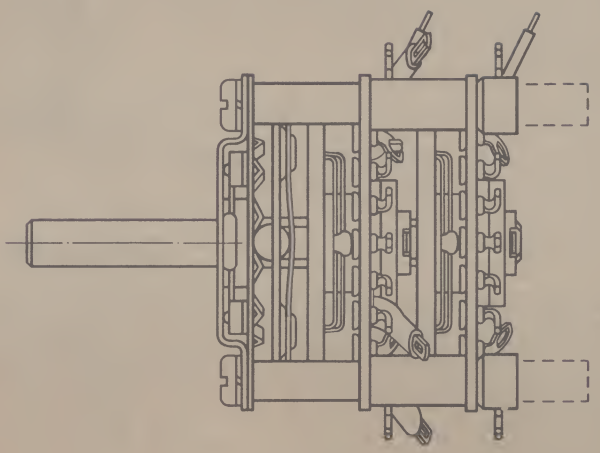


DIAGRAM 4

All dimensions identical to types A, C, D, E bushing mtg. types except bushing omitted.

MATERIALS

DETENT SPRING AND BALLS, SHAFT, MTG. PLATE, STOPS, BUSHING, MTG. HARDWARE, DETENT PLATE, BALL RETAINER—passivated stainless steel

WIPER ARMS—solid spring silver alloy (gold plate optional)

CONTACTS, COLLECTOR RINGS, (SEGMENTS)—solid silver alloy (gold plate optional)

STATOR (deck plate) — epoxy fiberglass

CONTACT LUGS—(integral with contacts) solid silver alloy

COMMON AND CORNER TERMINALS—copper alloy (tin dipped and teflon sleeve insulated)

ROTOR BEARING, ROTOR SPACERS, INSULATING CUPS—nylon

ROTOR — diallyl — phthalate (glass fibre reinforced)

STOP PIN RETAINER — nickel silver

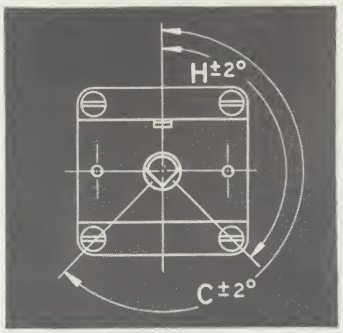
SCREWS, STUDS AND DETENT SPACERS—nickel plated brass

DECK SPACERS—steatite

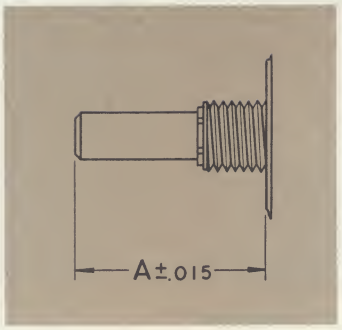
ALL MATERIALS SUBJECT TO CHANGE WITHOUT NOTICE

BACK OF PANEL DIMENSIONS VS. NUMBER OF DECKS

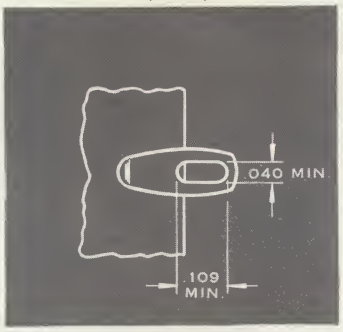
NUMBER OF DECKS	MAX. OVERALL LENGTH (Inches)	NOMINAL OVERALL LENGTH (Inches)	NOMINAL OVERALL LENGTH TOLERANCE (± Ins.)	
1	1.187			Without rear support spacers
2	1.760			
3	2.333			
4	2.906			
5	3.479			
6	To obtain maximum overall length add tolerance to nominal	4.190	.072	With rear support spacers
7		4.753	.082	
8		5.316	.092	
9		5.879	.102	
10		6.442	.112	
11		7.005	.122	
12		7.568	.132	
13		8.131	.142	
14		8.694	.152	
15		9.257	.162	
16		9.820	.172	
17		10.383	.182	
18		10.946	.192	
19		11.509	.202	
20		12.072	.212	



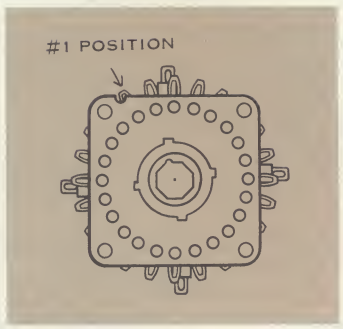
(FIG. 1)



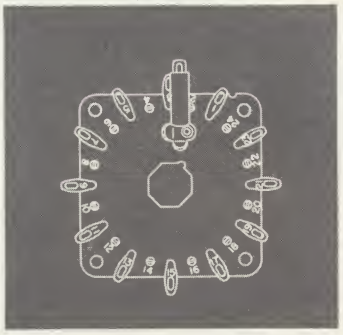
(FIG. 2)



(FIG. 3)



(FIG. 4)



(FIG. 5)

FLAT LOCATION (Figure 1)

Flat angle C is determined with the switch rotated fully CCW or to the #1 position if no stops are provided (see locating #1 position below). Angle H is used only if knobs with two set screws are required. Angle C is determined by a line drawn through the shaft center and the mounting tang (or mounting tang hole if the tang is not used) and a line perpendicular to the shaft flat. The standard flat angle tolerance is ±2°. Shaft flats are not supplied unless requested.

SHAFT LENGTH (Figure 2)

Measurement of shaft length is always made from front of shaft to the mounting surface (dimension A). The standard shaft length is one inch (optional lengths are available) and the standard dimensional tolerance is ± .015".

LUG DETAILS (Figure 3)

Standard terminal lug hole dimensions are as shown in Figure 3 (To accept a maximum of 2 #20 wire leads). The lugs are integral with contacts to assure maximum reliability and provide terminal strength ratings in excess of all military and commercial standards. All terminals are flared to promote accessibility and wiring ease.

LOCATING COMMON AND #1 POSITIONS (Figure 4)

The #1 lug position is located directly behind the notch provided for that purpose on each deck plate (Figure 4). Common terminals are identified by red teflon sleeving. The positions for all terminals (including commons) are located by using the deck configuration drawing for the appropriate switch type (see Shallcross spec. sheets #1 and #2 or pages 19-20-21 and diagram 1 page 6 of this catalog).

CONTACT MARKING (Figure 5)

MIL-S-3786 switches (style SR14) require contact marking as shown in Figure 5 at left. Standard commercial switches are not marked unless specified (at additional charge).

RECOMMENDED MOUNTING AND WIRING PROCEDURES

PANEL MOUNTING

Panel holes for bushing mounted switches should be .380" ±.005". Oversized panel holes may result in switch damage if mounting nuts are overtightened. Switches which will have dials on the panel should use the minimum panel hole dimension to avoid dial misalignment.

REAR MOUNTING SUPPORTS

Series 2 switches with more than five decks should use a rear mounting bracket (provisions for mounting rear brackets are standard but brackets themselves are not supplied except on special order). The mounting procedure for switches having more than 20 decks should be cleared by the Shallcross Engineering Department.

WIRING

Wiring procedures consistent with the best established standards for harnessing miniature electronic components must be used. A 60-80 watt soldering iron and a maximum soldering time of 3 seconds are recommended to avoid damage to switch contacts. Care should be taken to avoid depositing extraneous materials (solder, flux, wire strands and wire insulation particles) on switch decks, arms and contacts.

MIL-S-3786
STYLE SR14
SPECIFICATIONS

FOREWORD:
Shallcross Series 2 rotary switches meet all requirements of MIL-S-3786 style SR14. In conjunction with General Time solenoid equipment they, also, exceed all requirements of style SR16 of the same specification. A portion of the operating specifications and general requirements for style SR14 have been extracted or condensed and provided below.

GENERAL
Switches, Rotary (Circuit Selector, Low Capacity).

DESIGN AND CONSTRUCTION
All switches shall be of the design construction and physical dimensions shown in style SR14 MIL-S-3786

ROTATIONAL LIFE
The temperature — life characteristics shall be test-condition letter C except that the electrical rotational life of the switch shall be 50,000 cycles (proposed test condition E). After life (rotational) the torque shall change not more than 35 percent of its initial value. A cycle shall consist of 360 degrees minus the degrees in one throw in a clockwise direction and an equal number of degrees in a counterclockwise direction. The test loads for the applicable circuit conditions shall be as shown in Table V.

TABLE V — CIRCUIT VALUES FOR LIFE (ROTATIONAL) TEST

	Inductive load (2.8 henries)		Resistive loads (a.c. or d.c.)	
	Milliamperes	Volts d.c.	Milliamperes	Volts
At atmospheric pressure	50	30	500 50	30 300

ROTATIONAL TORQUE
The minimum and maximum values of torque determined for shaft rotation shall be within the limits shown in Table IV.

TABLE IV — ROTATIONAL — TORQUE LIMITS

Temperature	Torque (lb-in.)		
		Up to 5 sections or 10 poles	Up to 10 decks or 15 poles
	Minimum	Maximum	Maximum
Room	1½	6	10
—65°C	1½	8	13

CONTACT RESISTANCE
Contact resistance shall not exceed the following values:

Initial and after vibration and shock	5 milliohms
After moisture-resistance and salt spray	5 milliohms
After life (rotational) tests	10 milliohms

TORQUE (stops)
Single shaft switches containing stops shall withstand a torque of 50 pound-inches applied to the shaft against the stops in clockwise and counterclockwise directions.

INSULATION RESISTANCE Per MIL-S-3786

VOLTAGE BREAKDOWN (at atmospheric pressure) INITIAL — 1500 volts RMS
END OF LIFE — 1000 volts RMS

TEMPERATURE RANGE −65°C to +125°C

VIBRATION 10-2000 cps per MIL-S-3786

SALT SPRAY 48 hours per MIL-S-3786

SHOCK High impact per MIL-S-3786

THERMAL SHOCK Per MIL-S-3786

ELECTRICAL RATINGS

LOAD (BREAKING) VS. LIFE (CYCLES)	
LOAD	LIFE
0 VDC, 0 AMPS	100,000
10 VDC, 10.0 AMPS	25,000
30 VDC, 4.0 AMPS	10,000
30 VDC, 2.0 AMPS	20,000
30 VDC, 1.0 AMP	50,000
100 VDC, 0.5 AMP	20,000
100 VDC, 0.25 AMP	25,000
250 VDC, 0.1 AMP	50,000
300 VDC, 0.05 AMP	50,000
120 VAC, 2.0 AMPS	10,000
10 VDC, 5.0 AMPS	40,000
120 VAC, 0.5 AMP	30,000

LOAD-LIFE RATING METHODS

All commercial load-life ratings were obtained from tests made under normal room conditions. One life cycle consisted of one full rotation both clockwise and counterclockwise.
The following criteria were established as a failure definition:

1. MAXIMUM ALLOWABLE CONTACT RESISTANCE (ANY CONTACT)

MAXIMUM CONTACT RESISTANCE	APPLIED LOADS (TO AND INCLUDING)
.004Ω	30 VOLT AMPERES
.006Ω	50 VOLT AMPERES
.01 Ω	240 VOLT AMPERES

2. MINIMUM ALLOWABLE VOLTAGE BREAKDOWN — 800 volts RMS (between any two active positions or to ground).

3. MINIMUM ALLOWABLE INSULATION RESISTANCE — 10^{12} ohms (between any two active positions or to ground).

4. MECHANICAL FAILURE — rotational failure, arm misalignment, contact misalignment, etc., (Electrical failure preceded mechanical failure for every sample tested).

CURRENT CARRYING CAPACITY

10 AMPS (FOR TEMPERATURE RISE < 30°C)

VOLTAGE BREAKDOWN

(—55°C TO +85°C, 50% RH, SEA LEVEL)

	INITIAL (MINIMUM)	END OF LIFE (MINIMUM)
BETWEEN POLES	2000 V RMS (60 CYCLES)	1000V RMS (60 CYCLES)
BETWEEN CONTACTS	1500 V RMS (60 CYCLES)	800V RMS (60 CYCLES)
TO GROUND	3000 V RMS (60 CYCLES)	2000V RMS (60 CYCLES)
BETWEEN DECKS	6000 V RMS (60 CYCLES)	4000V RMS (60 CYCLES)

INSULATION RESISTANCE (room conditions)

INITIAL > 10^{14}

END OF LIFE > 10^{12}

THERMAL EMF

1 μ VOLT /°C (MAXIMUM)

ELECTRICAL RATINGS (CONTIN

CAPACITANCE

POINTS OF MEASUREM
BETWEEN ADJACENT ACTIVE CONTAC
BETWEEN CONTACT AND COMMON
BETWEEN COMMON AND FRAME
BETWEEN POLES (2 POLES/DECK)
BETWEEN POLES (3 & 4 POLES/DE

CONTACT RESISTANCE

INITIAL — .002 OHMS MA
VARIATION — SEE CHART

ENVIRONM

TEMPERATURE RANGE

—40°C to +85°C (WHERE
RATINGS ARE TO BE MET
—65°C to +125°C (WHEF
DERATED)

MECHANI

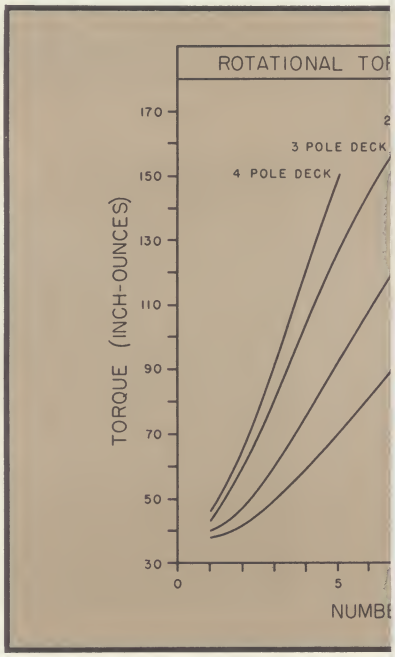
STOP STRENGTH

WITHSTAND 50 IN/LB RO

TERMINAL STRENGTH

WITHSTAND 5 LB PULL TI
PERPENDICULAR PLANES

ROTATIONAL TORQUE



NGS (COMMERCIAL)

UED)

NT	CAPACITANCE
TS	.7 μμf MAXIMUM
ERMINAL	.7 μμf MAXIMUM
	5.0 μμf MAXIMUM
	2.0 μμf MAXIMUM
CK)	1.5 μμf MAXIMUM

XIMUM
S 101-105

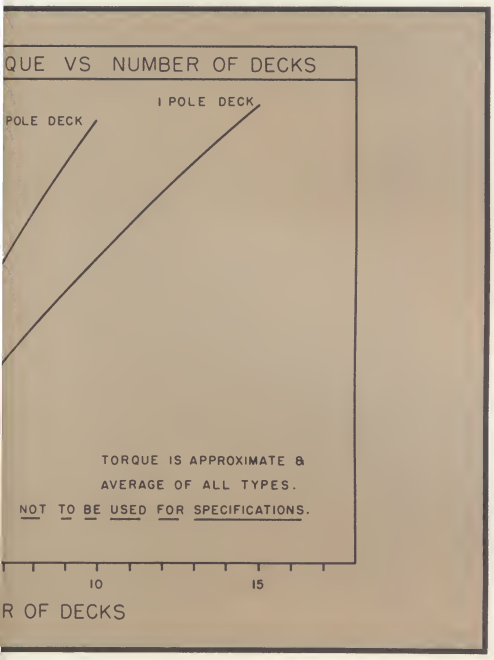
ENTAL RATINGS

E ALL OTHER COMMERCIAL
)
E LIFE RATINGS CAN BE

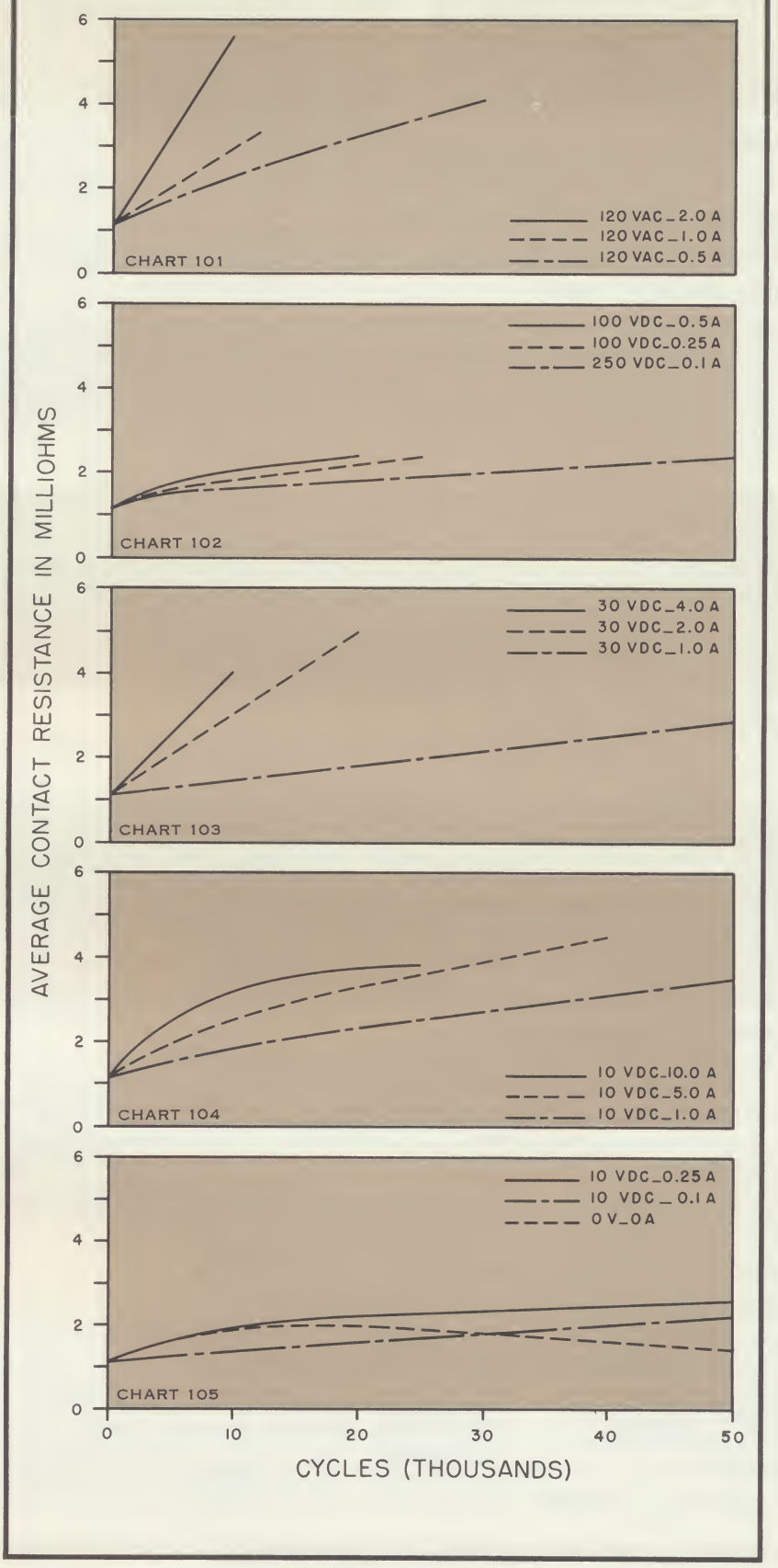
CAL RATINGS

TATIONAL FORCE (MINIMUM)

HREE MUTUALLY



CONTACT RESISTANCE VS. LOAD VS. LIFE



SERIES 1, 2 OR 4 ORDERING INFORMATION

FOREWORD—The Shallcross switch order code system and/or reproducible specification sheets provide an exceptionally convenient and "error free" ordering method for Series 1, Series 2 or Series 4 rotary switches. The order code is sufficient for standard switch requirements not requiring a master drawing. The dual purpose specification sheets provide reproducible control drawings for your records as well as specification sheets for quotations or ordering.

ORDERING CODE

The part number system presented in the chart below permits the ordering of any standard Series 2, Series 4, or Series 1 rotary switch (and most standard options). Switch types and options that cannot be specified using this code will be assigned special part numbers (see "ordering specials").

SAMPLE ORDERING CODE

STANDARD SWITCH CODE							STANDARD OPTION CODE				
2	J	50	A	12	—	4	—	D	K	12	M
SERIES NUMBER	INDEXING ANGLE	DECK CONFIGURATION	MOUNTING TYPE	POSITIONS PER POLE	DASH	NUMBER OF DECKS	DASH	DUST COVERS	GOLD PLATING	OPTIONAL SHAFT LENGTHS	CUSTOMER MARKING
Series 2 (1¾") Rotary Switches (Insert 4 or 1 for Series 4 and 1 switches respectively)	Select Your Preferred Switch Type From **ORDER CHARTS SUPPLIED FOR EACH SWITCH SERIES**		From Chart Page 12 (Series 2), Page 27 (Series 4), Or Page 7 (Series 1)	Make Certain Number Of Positions Per Pole And Number Of Decks Do Not Exceed Maximum Available For Switch Type Ordered.				Add Letter D If Dust Covers Are Required See Page 22 (Series 2 Only)	Add Letter K If Gold Plated Current Carrying Parts Are Required See Page 23	For Shaft Lengths Other Than Standard 1" Length Add Appropriate Code Number From Chart Page 12	Add Letter M If Your Part Number As Well As Shallcross Part Number Is To Be Marked On Switch Mounting Plate
Omit Code Numbers For Standard Options Not Required											

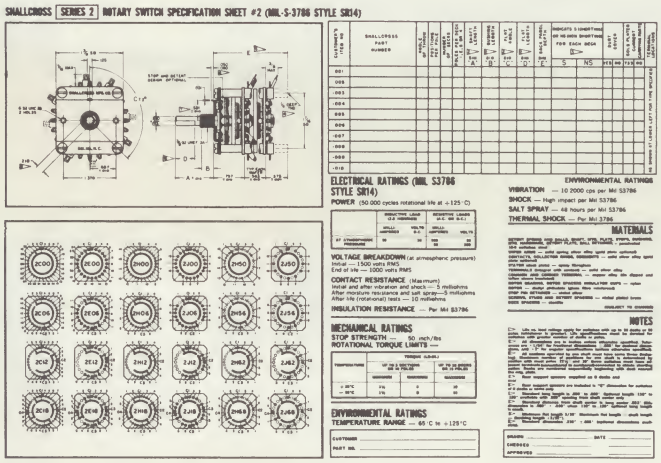
ORDERING SPECIALS

Special switches and/or standard options that cannot be specified using the part number system above (flatted shafts, cluster arms, dual-concentric shafts, special wiring, etc.) will be assigned a code number by the factory. Provide the part number for your preferred basic switch type and either a Shallcross specification sheet (below) or your own written specifications for the deviations needed. A suffix four digit code will be added to the base switch part number to define these deviations. The complete part number must be used for any subsequent orders.

EXAMPLE SPECIAL CODE NUMBER

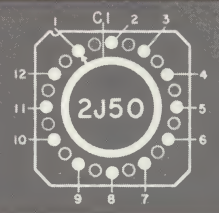
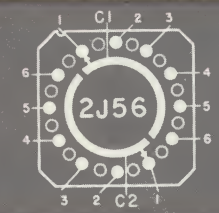
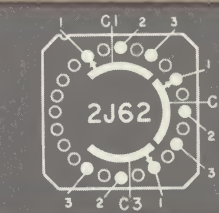
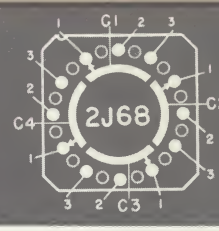
2J50A12-5	X60N
Basic Switch Type	Special Code

SPECIFICATION SHEETS


SHALLCROSS SERIES 2 ROTARY SWITCH SPECIFICATION SHEET #2 (MIL-S-3786 STYLE SR14)

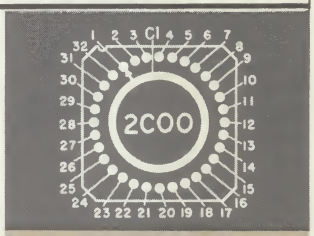
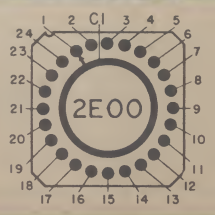
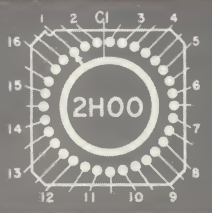
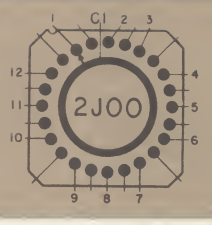
Series 2 specification sheets #1 and #2, Series 4 sheets #3 and #4 and Series 1 sheet #5 are provided to eliminate format and technical errors in creating reproducible control drawings for your records, when needed. Copies of all sheets are included with this catalog (additional copies are available on request). Step by step instructions for completion of these sheets are furnished on pages 24 and 25.

SHALLCROSS SERIES 2 NONSHORTING SWITCHES

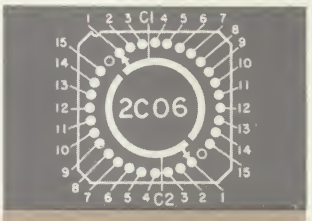
	SHALLCROSS SERIES	INDEXING ANGLE	MAXIMUM POSITIONS PER POLE WITH STOPS	MAXIMUM POSITIONS PER POLE, NO STOPS	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
1 POLE PER DECK	2H50	22½°	16	16	20	
	2J50	30°	12	12	20	
2 POLES PER DECK	2H56	22½°	8	CONTINUOUS ROTATION NOT AVAILABLE	12	
	2J56	30°	6	CONTINUOUS ROTATION NOT AVAILABLE	12	
3 POLES PER DECK	2H62	22½°	4	CONTINUOUS ROTATION NOT AVAILABLE	8	
	2J62	30°	3	CONTINUOUS ROTATION NOT AVAILABLE	8	
4 POLES PER DECK	2H68	22½°	4	CONTINUOUS ROTATION NOT AVAILABLE	6	
	2J68	30°	3	CONTINUOUS ROTATION NOT AVAILABLE	6	

SHALLCROSS SERIES 2 SHORTING SWITCHES

1 POLE PER DECK

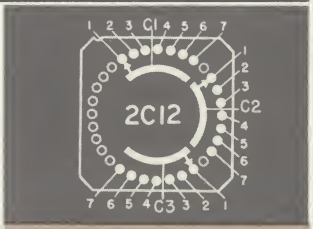
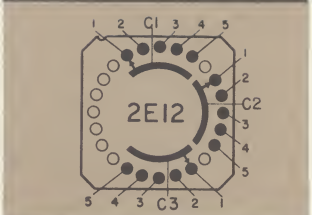
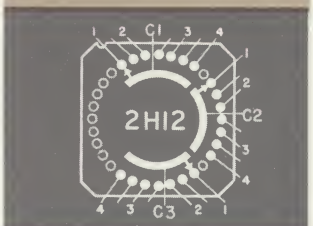
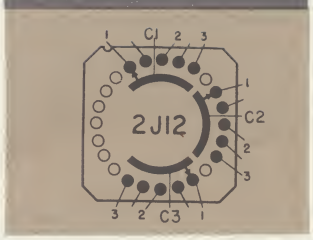
SHALLCROSS SERIES	INDEXING ANGLE	MAXIMUM POSITIONS PER POLE WITH STOPS	MAXIMUM POSITIONS PER POLE, NO STOPS	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
2C00	11¼°	31	32	20	
2E00	15°	23	24	20	
2H00	22½°	16	16	20	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					
2J00	30°	12	12	20	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					

2 POLES PER DECK

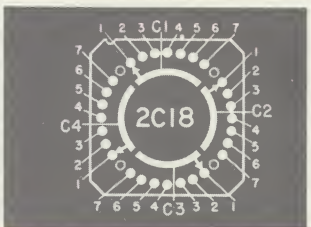
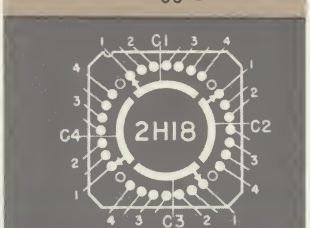
SHALLCROSS SERIES	INDEXING ANGLE	MAXIMUM POSITIONS PER POLE WITH STOPS	MAXIMUM POSITIONS PER POLE, NO STOPS	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
2C06	11¼°	15	CONTINUOUS ROTATION NOT AVAILABLE	12	
2E06	15°	11	CONTINUOUS ROTATION NOT AVAILABLE	12	
2H06	22½°	8	CONTINUOUS ROTATION NOT AVAILABLE	12	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					
2J06	30°	6	CONTINUOUS ROTATION NOT AVAILABLE	12	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					

SHALLCROSS SERIES 2 SHORTING SWITCHES

3 POLES PER DECK

SHALLCROSS SERIES	INDEXING ANGLE	MAXIMUM POSITIONS PER POLE WITH STOPS	MAXIMUM POSITIONS PER POLE, NO STOPS	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
2C12	11¼°	7	CONTINUOUS ROTATION NOT AVAILABLE	8	
2E12	15°	5	CONTINUOUS ROTATION NOT AVAILABLE	8	
2H12	22½°	4	CONTINUOUS ROTATION NOT AVAILABLE	8	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					
2J12	30°	3	CONTINUOUS ROTATION NOT AVAILABLE	8	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					

4 POLES PER DECK

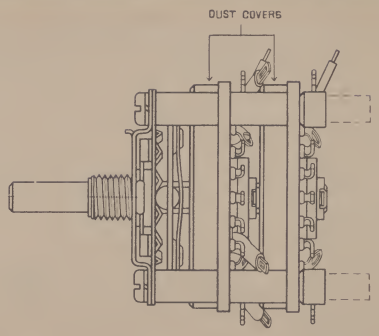
SHALLCROSS SERIES	INDEXING ANGLE	MAXIMUM POSITIONS PER POLE WITH STOPS	MAXIMUM POSITIONS PER POLE, NO STOPS	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
2C18	11¼°	7	CONTINUOUS ROTATION NOT AVAILABLE	6	
2E18	15°	5	CONTINUOUS ROTATION NOT AVAILABLE	6	
2H18	22½°	4	CONTINUOUS ROTATION NOT AVAILABLE	6	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					
2J18	30°	3	CONTINUOUS ROTATION NOT AVAILABLE	6	
ADJACENT UNNUMBERED AND NUMBERED TERMINALS MUST BE CONNECTED IN PAIRS TO OBTAIN SHORTING ACTION					

STANDARD OPTIONS

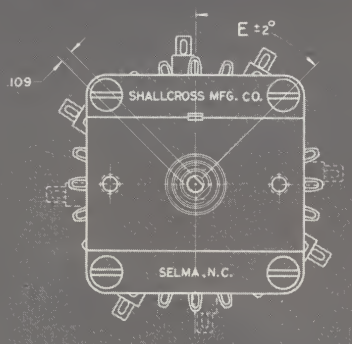
All Standard options described in this foldout are readily available (concentric shaft, spring return and solenoid options will require slightly longer delivery in some cases due to their normally custom nature). Most can be specified using the standard Shallcross part number system but those options without code numbers should be ordered by using Shallcross specification sheets or your own drawings.

DUST COVERS

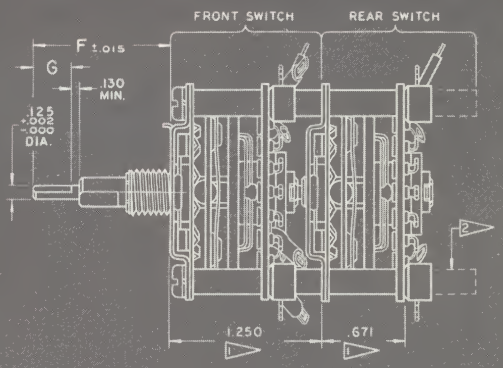
Translucent plastic dust covers for each switch deck provide enhanced voltage breakdown and contact resistance reliability by reducing the possibility of dust and stray particle accumulations on the switch arms, contacts and collector rings. Special rotors and spacers permit the addition of dust covers without altering standard OD and back panel dimensions.



DUAL CONCENTRIC SHAFT

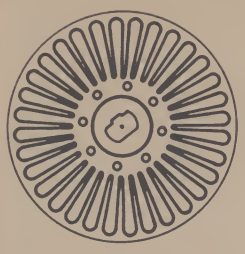


Series 2 dual concentric shaft versions result in a 50% reduction of panel space requirements where their use is appropriate. Two independent switch groups (or switch and potentiometer combinations) are operated by the dual concentric shaft to eliminate the need for 2 separate component mountings. Up to 4 decks per shaft can be supplied.



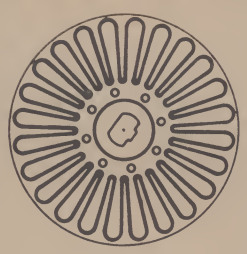
2 Dimensions shown are for one deck on each switch. Add .563 ± .010 for each additional deck on either front or rear switch.
2 Rear support spacers are supplied on switches having a total (front & rear switch decks) of 5 or more decks.
3 In addition to dimensions shown, specify .250 diameter shaft length (and flat, if required), bushing, and nonturn tang same as standard series 2 switches.
4 Specify and supply Shallcross part number (same as standard series 2 code) for both front and rear switches. Specify largest number of poles on front switch (.250 dia. shaft).

CLUSTER ARMS



32 POSITION
Cluster Arm

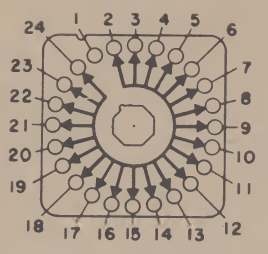
DIAG (1)



24 POSITION
Cluster Arm

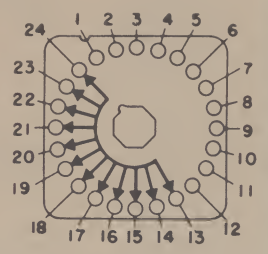
DIAG (2)

24 or 32 position cluster arms can be programmed by removing selected fingers to provide progressive shorting or opening switching action. Clusters will be programmed to your requirements by the factory if the fingers to be removed are specified. A maximum of 4 cluster decks per switch is recommended.



PROGRESSIVE
Opening (Typical)

DIAG (3)



PROGRESSIVE
Shorting (Typical)

DIAG (4)

CLUSTER ARM NOTES

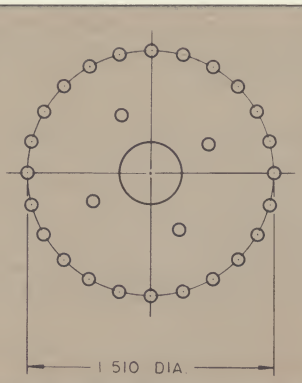
(1) Wiper arms are shown schematically (as in diagrams 3 & 4 above). Fingers can be omitted as specified but those remaining are electrically common.
(2) Number 1 contact should be used as a reference. It will be assumed that reference to fingers by number will be on the basis of the shaft in the extreme counterclockwise position or No. 1 position.
(3) Complete switch assemblies with cluster arm decks are identical to standard switch assemblies in size and mounting. Cluster arm and standard decks are physically interchangeable and may be ganged together.
(4) Connection to cluster arm can be supplied if specified, otherwise, one contact position must be sacrificed for use as a termination point.
(5) 30° or 15° indexing available on 24 finger clusters. 22½° or 11¼° indexing available on 32 finger clusters.

STANDARD OPTIONS

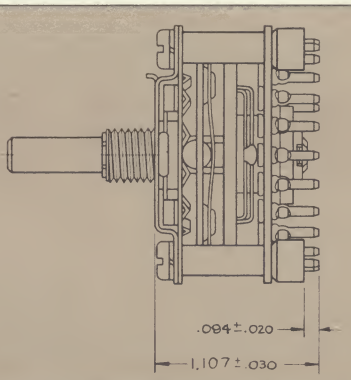
GOLD PLATING

Arms, contacts, and collector rings with a special hard gold .0001" plating are stocked to satisfy applications requiring corrosion proofed current carrying switch parts. Provisions are made for ordering in the standard part number system.

PRINTED CIRCUIT MOUNTING



The last deck on any Series 2 switch can be provided with terminals suitable for printed circuit board mounting. The diagram at left shows a typical terminal layout, however, the exact configuration will vary with the switch type used — layouts for your specific switch requirement will be provided on request.



SPRING RETURN

Spring return action (with or without detenting) can be supplied on all Series 2 switch types.

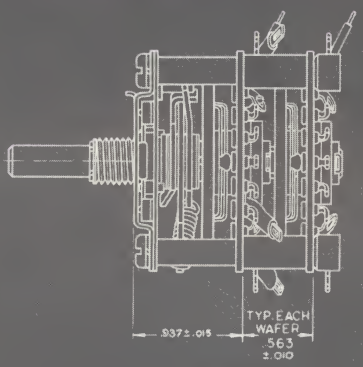


DIAGRAM 1

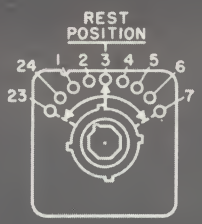


DIAGRAM 2

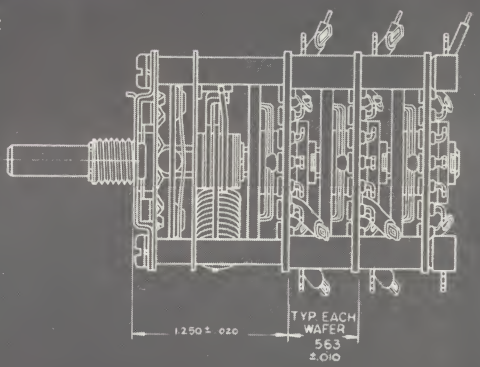


DIAGRAM 3

SPRING RETURN NOTES

1. Size, mounting and deck configurations are same as standard series 2, except back of panel depth is increased to provide for spring (See diagrams 1 & 3 above).
2. Specify operation desired by referencing from rest position (Diagram 2 above). Rest position may be moved from that shown to meet operation requirements.
   EXAMPLE
   A. 3 Positions clockwise, spring return
      1 Position counterclockwise, detent
      5 Positions total, including rest
   B. 2 Positions clockwise, spring return with detent feel
      0 Positions counterclockwise
      3 Positions total, including rest
3. Maximum throw with spring return must be limited to 75°. Maximum number of positions can be determined from throw of type specified.
4. Maximum number of poles with spring return should be limited to six.

SOLENOID DRIVE

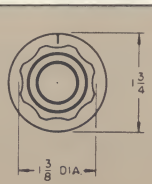
Series 2 switches are adapted to General Time, Inc., and Ledex, Inc., solenoids and offered as standard assemblies.

The General Time Assembly meets all requirements of MIL S3785 Style SR16. Inquiries regarding Shallcross solenoid units should be directed to:

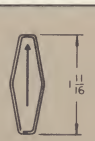
Ledex, Inc.
123 Webster Street
Dayton 2, Ohio

General Time Corporation
Central Research Laboratory
Progress Drive
Stamford, Connecticut

STANDARD KNOBS

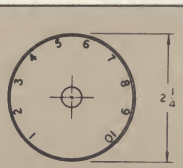


AM27236

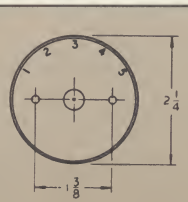


AM26989

STANDARD DIALS



AS24-0A00



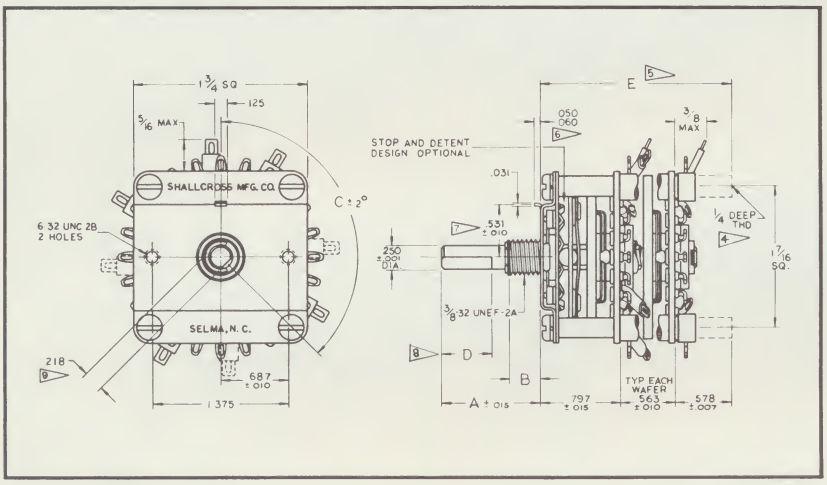
AS24-0B00

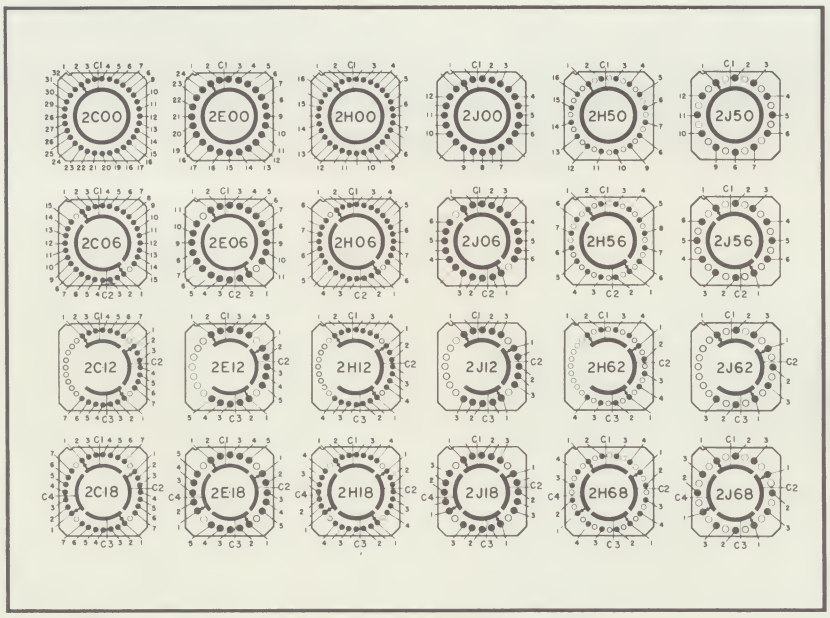
SPECIFY SWITCH CODE IN ADDITION TO DIAL PART NUMBER.

SHALLCROSS SPECIFICATION SHEET INSTRUCTIONS

1 2 3 4 5 6 7 8 9 10

SHALLCROSS SERIES 2 ROTARY SWITCH SPECIFICATION SHEET #2 (MIL-S-3786 STYLE SR14)





CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF DECKS	POLES PER DECK 1, 2, 3 OR 4	SHAFT LENGTH ▽ DIM. "A"	BUSHING LENGTH ▽ DIM. "B"	FLAT ANGLE ▽ DIM. "C"	FLAT LENGTH ▽ DIM. "D"
-001	2J50A12-3D	30°	12	3	1	1"	5/16"	—	—
-002	2C00B32-5-K06	11½°	32	5	1	¾"	0	—	—
-003	2J00C11-6 (XXXX)	30°	11	6	1	1¼"	½"	—	—
-004	2J56A6-2 (XXXX)	30°	6	2	2	1"	5/16"	105°	½"
-005									
-006									
-007									
-008									
-009									
-010									

SUFFIX CODES ADDED BY FACTORY TO DENOTE FLAT ANGLES OR OTHER SPECIAL REQUIREMENTS NOT COVERED BY STANDARD PART #

SAMPLE

ELECTRICAL RATINGS (MIL S3786 STYLE SR14)

POWER (50,000 cycles rotational life at +125°C)

▷	INDUCTIVE LOAD (2.8 HENRIES)		RESISTIVE LOADS (A.C. OR D.C.)	
	MILLI-AMPERES	VOLTS D.C.	MILLI-AMPERES	VOLTS
AT ATMOSPHERIC PRESSURE	50	30	500 50	30 300

VOLTAGE BREAKDOWN (at atmospheric pressure)
Initial — 1500 volts RMS
End of life — 1000 volts RMS

CONTACT RESISTANCE (Maximum)
Initial and after vibration and shock — 5 milliohms
After moisture resistance and salt spray—5 milliohms
After life (rotational) tests — 10 milliohms

INSULATION RESISTANCE — Per Mil S3786

MECHANICAL RATINGS

STOP STRENGTH — 50 inch/lbs.

ROTATIONAL TORQUE LIMITS —

TEMPERATURE	TORQUE (LB-IN.)		
	UP TO 5 SECTIONS OR 10 POLES		UP TO 10 DECKS OR 15 POLES
	MINIMUM	MAXIMUM	MAXIMUM
+ 25°C	1½	6	10
— 65°C	1½	8	13

ENVIRONMENTAL RATINGS

TEMPERATURE RANGE — 65 C to +125°C

CUSTOMER _____

PART NO. _____

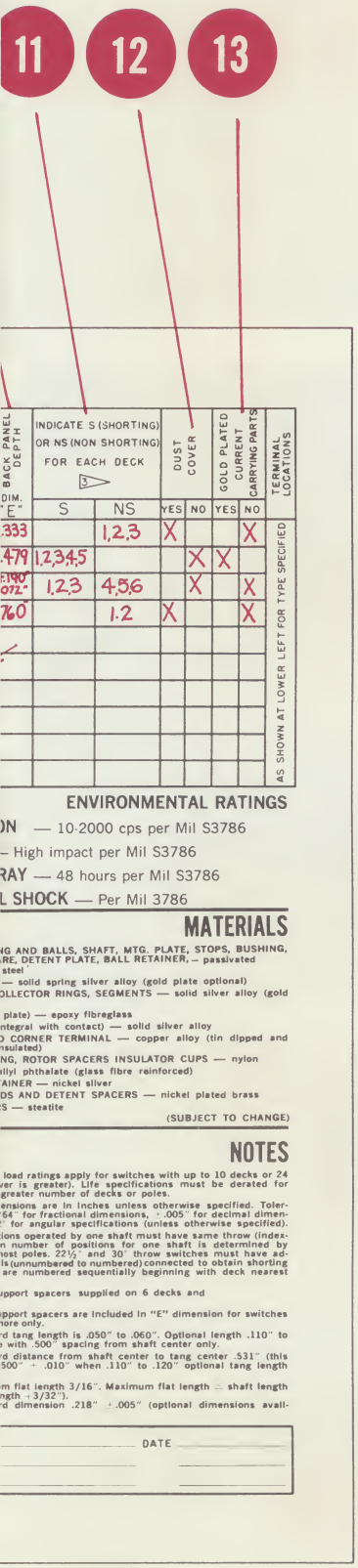
VIBRATI
SHOCK
SALT SF
THERM/

DETENT SPR
MTG. HARDW
18-8 stainles
WIPER ARM
CONTACTS,
plate optiona
STATOR (dec
TERMINALS
COMMON A
teflon sleeve
ROTOR BEA
ROTOR — d
STOP PIN RI
SCREWS, ST
DECK SPACE

▷ Life v
poles (which
switches wit
▷ All di
ances are
sions, and
▷ All se
ing). Maxim
section with
jacent termir
action. Deck
the mtg. plat
▷ Rear
over.
▷ Rear
of 6 decks or
▷ Stand
.120" availab
▷ Stand
dimension is
is used).
▷ Minim
(bushing
▷ Stand
able).

DRAWN
CHECKED
APPROVED

14



FOREWORD As a convenience to Shallcross switch users, reproducible specification sheets are provided for SERIES 1, SERIES 2 and SERIES 4 rotary switches to reduce the time required for creating accurate, comprehensive control drawings or ordering specifications. After completion, the original sheet should be retained for your files and two copies forwarded with your quotation request or order (the factory will review your specifications and return a corrected copy if revisions are required). Please note that specification sheets for both commercial and military applications are provided for each switch group — you may select your preferred format. For all standard switches the Shallcross ordering code is self-sufficient, however, specification sheets are recommended where control drawings or special options and specifications are required.

1 **Select your preferred switch type from pages 9 and 10 (SERIES 1), pages 19, 20 and 21 (SERIES 2), or page 30 (SERIES 4). Insert the switch number described on page 18 (SERIES 2 and 4) or page 10 (SERIES 1). When special options and/or specifications are required the factory will add a suffix 4 digit code to the basic part number and return a copy of your specification sheet with the completed code — your control drawing must be altered to show the complete part number.**

2 Insert the angle of throw (indexing) for the switch type selected.

3 Insert the positions per pole for the switch type selected (make certain the number specified does not exceed the maximum available for your preferred type).

4 Insert the total number of decks required if a SERIES 2 or SERIES 4 switch type has been selected or the total poles if a SERIES 1 switch is being specified (make certain the number specified does not exceed the maximum available).

5 Insert the poles per deck if SERIES 2 or 4 switches are being specified (This column is omitted and not required on SERIES 1 specification sheets).

6 Insert your preferred shaft length (a 1" shaft is standard but optional lengths are available).

7 Select your preferred mounting type from page 7 (SERIES 1), page 12 (SERIES 2) or page 27 (SERIES 4) and insert the bushing length dimension.

8 If flats are required, insert your preferred flat angle per the method described on page 14 (Flats are not supplied unless specified).

9 Insert your preferred flat length dimension if flats are required. The minimum length is 3/16" and the maximum is determined by adding 3/32" to the bushing length and subtracting the total from the shaft length.

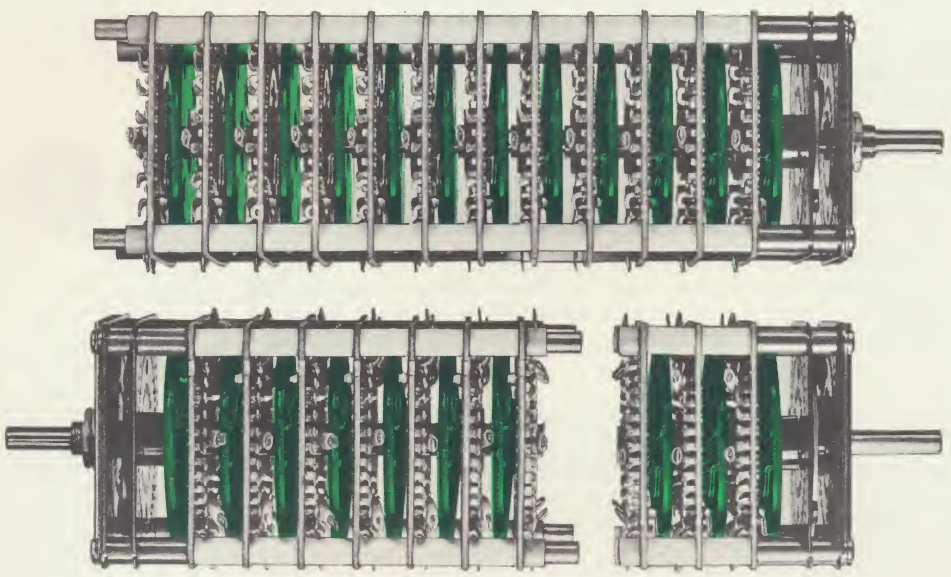
10 Insert back of panel to rear of switch dimension. Dimensions for each switch type are provided on page 7 (SERIES 1), page 13 (SERIES 2) and page 27 (SERIES 4). To permit a more exact location of rear mounting supports the mean dimension and tolerances must be supplied when the total number of decks exceeds 5 (SERIES 2), 4 (SERIES 4) or 10 (SERIES 1). Maximum back panel dimensions are specified for all other switch types.

11 Where the indexing angle is 22 1/2° or 30° (SERIES 2) or 15° (SERIES 1 and SERIES 4) shorting and nonshorting decks with the same indexing can be combined in any combination on a single switch. Insert the deck number (SERIES 2 and SERIES 4) or pole number (SERIES 1) for each configuration in the appropriate block (decks or poles are numbered consecutively beginning with the deck or pole nearest the mounting plate).

12 Insert an X in the appropriate box if deck dust cover (described on page 22) are or are not preferred. (SERIES 2 only)

13 Insert an X in the appropriate box if gold plated current carrying parts (described on page 23) are or are not preferred.

14 Insert your company name, drawing number and date.



FEATURES:

1. Meet all requirements of MIL-S-3786 Style SR15.
2. Up to 48 positions per deck.
3. Select glass fibre impregnated epoxy laminate decks promote maximum structural strength and insulation resistance.
4. Special configuration dual leaf wiper arms provide exceptionally low and stable contact resistance.
5. Adjustable stops.
6. Compact design affords reduced back panel depths.
7. Flared terminal lugs (integral with contacts) promote wiring ease.
8. Coin silver and silver alloy current carrying parts assure thermal EMF ratings below 1 microvolt/°C.
9. Captive Dual balls riding a ball and socket type detent establish positive, long life detenting.
10. Insulation resistance ratings in excess of 10^{14} ohms.
11. Definitive Ratings.

GENERAL

Shallcross Series 4 rotary switches are similar in design to their Series 2 counterparts, however, the deck dimension has been increased to 2½" to provide 48 contacts per deck and the detent mechanism has been altered to assure positive and accurate indexing. The OD dimension for many 48 position switches is slightly less than the 2½" chosen for series 4 equivalents, however, the larger dimension was selected to assure higher voltage breakdown ratings, more accurate detenting and enhanced overall reliability. Back of panel space requirements for all Series 4 types are appreciably less than those required for competitive switches in the same class.

The exceptional structural strength, contact resistance, insulation resistance and thermal EMF characteristics of this switch group recommends their application in MIL-S-3786, Style SR15, military applications, space and missile high reliability requirements, and precision commercial instrumentation.

SHALLCROSS SERIES 4 DIMENSIONS AND MECHANICAL SPECIFICATIONS

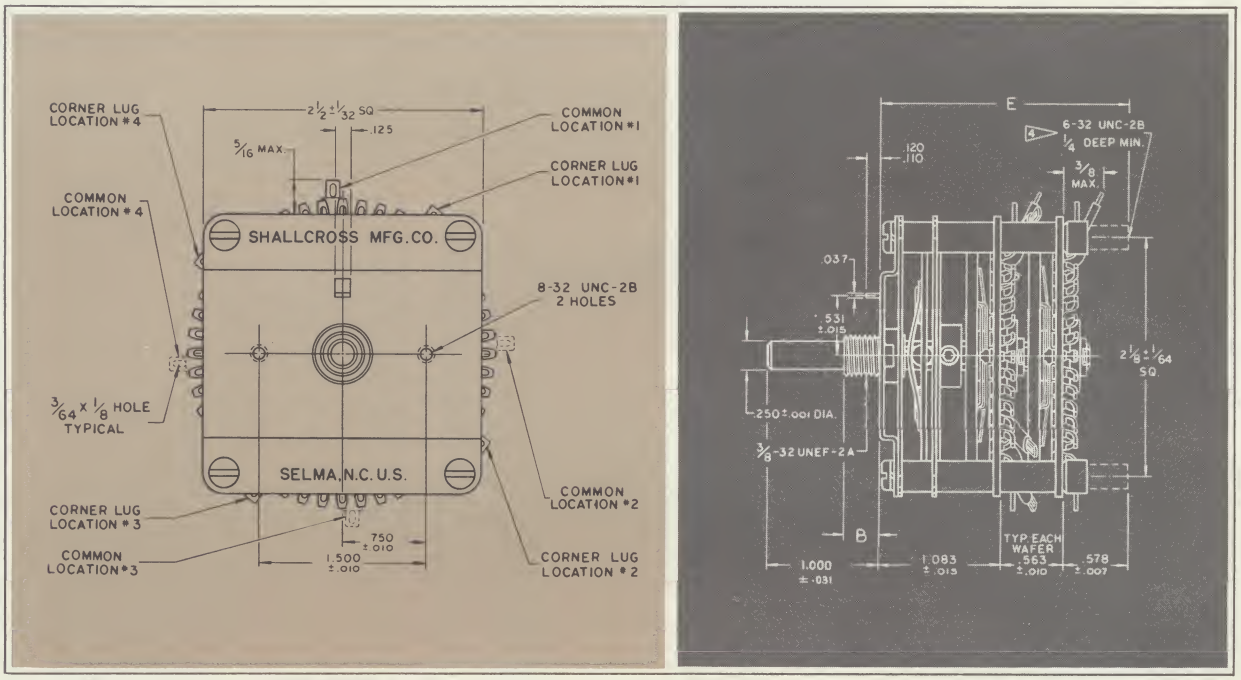


DIAGRAM 1

DIAGRAM 2

4 Rear support spacers and nylon cups are supplied (and included in E dimension) on 5 decks and over.

COMMON AND CORNER TERMINAL LOCATIONS

SWITCH TYPE		TERMINAL LOCATIONS FROM (DIAGRAM 1)	
		COMMON TERMINALS	CORNER TERMINALS
1 POLE PER DECK	4A00	#1	ALL FOUR
	4E50	#1	NONE
2 POLES PER DECK	4A06	#1 & #3	#1 & #3
	4E56	#1 & #3	NONE
3 POLES PER DECK	4A12	#1, #2 & #3	NONE
	4E62	#1, #2 & #3	NONE
4 POLES PER DECK	4A18	ALL FOUR	NONE
	4E68	ALL FOUR	NONE

BACK OF PANEL DIMENSIONS VS. NUMBER OF DECKS

NUMBER OF DECKS	MAX. OVERALL LENGTH (INCHES)	NOMINAL OVERALL LENGTH (INCHES)	NOMINAL OVERALL LENGTH TOLERANCE (± IN.)
1	1.473		
2	2.046		
3	2.619		
4	3.192		
5	TO OBTAIN MAXIMUM OVERALL LENGTH ADD TOLERANCE TO NOMINAL	3.913	.062
6		4.476	.072
7		5.039	.082
8		5.602	.092
9		6.165	.102
10		6.728	.112
11		7.291	.122
12		7.854	.132
13		8.417	.142
14		8.980	.152
15		9.543	.162

MATERIALS

Detent Spring and Balls, Shaft, Mtg. Plate, Stops, Bushing. Mtg. Hardware, Detent Plate, Ball Retainer, Stop Pin Retainer, Detent Spacers — Passivated Stainless Steel

Wiper Arms — Solid Spring Silver Alloy (Gold Plate Optional)

Contacts, Collector Rings, (Segments)— Solid Silver Alloy (Gold Plate Optional)

Stator (Deck Plate) — Epoxy Fiberglass

Contact Lugs — (Integral with Contacts) Solid Silver Alloy

Common and Corner Terminals—Copper Alloy (Tin Dipped and Teflon Sleeve Insulated)

Rotor Bearing, Rotor Spacers, Insulating Cups — Nylon

Rotor — Diallyl Phthalate (Glass Fibre Reinforced)

Screws and Studs — Nickel Plated Brass. Deck Spacers — Steatite

ALL MATERIALS SUBJECT TO CHANGE WITHOUT NOTICE

SHAFT LENGTHS

SHAFT LENGTHS ARE MEASURED FROM END OF SHAFT TO MOUNTING SURFACE. STANDARD SHAFT LENGTH IS ONE INCH (± .031"). OPTIONAL SHAFT LENGTHS FROM ⅝ TO 2 ARE AVAILABLE. SHALLCROSS CODE NUMBERS FOR OPTIONAL SHAFT LENGTHS ARE AS FOLLOWS:

SHAFT LENGTH	⅝	¾	⅞	1⅛	1¼	1⅜	1½	1⅝	1¾	2
SHALLX CODE	05	06	07	11	12	13	14	15	16	20

STANDARD MTG. BUSHING LENGTHS

SHALLX TYPE	BUSHING LENGTH (DIM. B)
A	5/16
B	0
C	1/2
D	3/8
E	3/4
ALL BUSHINGS ARE 3/8-32 UNEF-2A	

ELECTRICAL RATINGS

LOAD (BREAKING) VS LIFE (CYCLES)	
LOAD	LIFE
0 VOLTS, 0 AMPS	50,000
10 VDC, 10 AMPS	50,000
30 VDC, 4.0 AMPS	5,000
30 VDC, 2.0 AMPS	20,000
30 VDC, 1.0 AMP	50,000
100 VDC, 0.5 AMP	25,000
120 VAC, 2.0 AMPS	5,000
120 VAC, 1.0 AMP	10,000
120 VAC, 0.5 AMP	35,000
120 VAC, 0.25 AMP	50,000

LOAD-LIFE RATING METHODS

All commercial load-life ratings were obtained from tests made under normal room conditions. One life cycle consisted of one full rotation both clockwise and counterclockwise.
The following criteria were established as a failure definition:

1. MAXIMUM ALLOWABLE CONTACT RESISTANCE (ANY CONTACT)

MAXIMUM CONTACT RESISTANCE	APPLIED LOADS (TO AND INCLUDING)
.004Ω	30 VOLT AMPERES
.006Ω	50 VOLT AMPERES
.01 Ω	240 VOLT AMPERES

2. MINIMUM ALLOWABLE VOLTAGE BREAKDOWN — 800 volts RMS (between any two active positions or to ground).

3. MINIMUM ALLOWABLE INSULATION RESISTANCE — 10^{12} ohms (between any two active positions or to ground).

4. MECHANICAL FAILURE — rotational failure, arm misalignment, contact misalignment, etc., (Electrical failure preceded mechanical failure for every sample tested).

CURRENT CARRYING CAPACITY

10 AMPS (FOR TEMPERATURE RISE < 30°C)

VOLTAGE BREAKDOWN

(—40°C TO +85°C, 50% RH, SEA LEVEL)

	INITIAL (MINIMUM)	END OF LIFE (MINIMUM)
BETWEEN POLES	2000 V RMS (60 CYCLES)	1000V RMS (60 CYCLES)
BETWEEN CONTACTS	1500 V RMS (60 CYCLES)	800V RMS (60 CYCLES)
TO GROUND	3000 V RMS (60 CYCLES)	2000V RMS (60 CYCLES)
BETWEEN DECKS	6000 V RMS (60 CYCLES)	4000V RMS (60 CYCLES)

INSULATION RESISTANCE (room conditions)

INITIAL > 10^{14}

END OF LIFE > 10^{12}

THERMAL EMF

1 μ VOLT/°C (MAXIMUM)

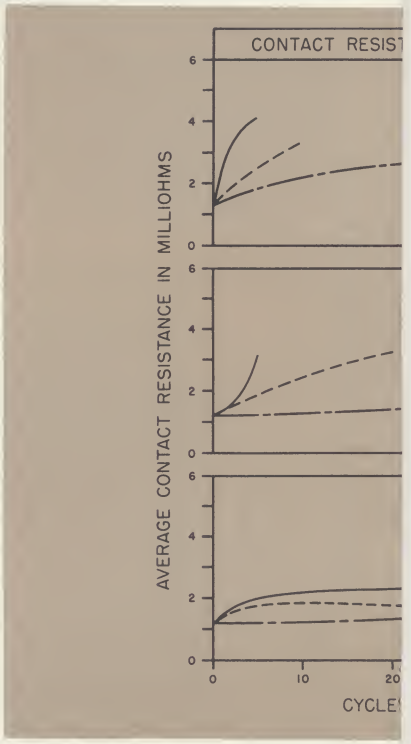
ELECTRICAL RATINGS (CONTINU

CAPACITANCE

POINTS OF MEASUREMEN
BETWEEN ADJACENT ACTIVE CONTACTS
BETWEEN CONTACT AND COMMON TE
BETWEEN COMMON AND FRAME
BETWEEN POLES —2 POLES/DECK
BETWEEN POLES —4 POLES/DECK

CONTACT RESISTANCE

INITIAL — .002 OHMS MAX



ENVIRONME

TEMPERATURE RANGE

—40°C to +85°C (WHERE RATINGS ARE TO BE MET)
—65°C to +125°C (WHER DERATED)

MECHANI

STOP STRENGTH

WITHSTAND 50 IN/LB ROT

TERMINAL STRENGTH

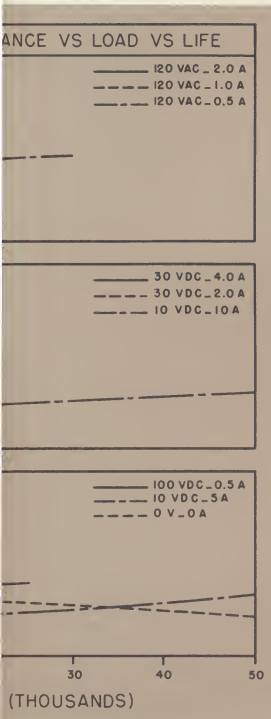
WITHSTAND 5 LB PULL TH PERPENDICULAR PLANES

GS

ED)

T	CAPACITANCE
	.7 μμf MAXIMUM
MINAL	.7 μμf MAXIMUM
	6.0 μμf MAXIMUM
	2.0 μμf MAXIMUM
	1.3 μμf MAXIMUM

MUM



NTAL RATINGS

ALL OTHER COMMERCIAL

E LIFE RATINGS CAN BE

CAL RATINGS

ATIONAL FORCE (MINIMUM)

REE MUTUALLY

MIL-S-3786 STYLE SR 15 RATINGS

FOREWORD— Shallcross Series 4 rotary switches meet all requirements of MIL-S-3786 Style SR15. A portion of the operating specifications and general requirements for this style have been extracted or condensed and provided below.

GENERAL

Switches, Rotary (circuit selector, low capacity)

DESIGN AND CONSTRUCTION

All switches shall be of the design construction and physical dimensions shown in Style SR15 MIL-S-3786

ROTATIONAL LIFE

The temperature—life characteristics shall be test-condition letter C
After life (rotational) the torque shall change not more than 35 per cent of its initial value. A cycle shall consist of 360 degrees minus the degrees in one throw in a clockwise direction and an equal number of degrees in a counterclockwise direction. The test loads for the applicable circuit conditions shall be as shown in Table V. Each condition shall be switched by at least one rotor contact of the switch.

TABLE V—CIRCUIT VALUES FOR LIFE (ROTATIONAL) TEST

	Inductive load (2.8 henries)		Resistive loads (a. c. or d. c.)	
	Milliamperes	Volts d. c.	Milliamperes	Volts
At atmospheric pressure	50	30	500 50	30 300

CONTACT RESISTANCE

Contact resistance shall not exceed the following values:

Initial and after vibration and shock ..... 5 milliohms
After moisture-resistance and salt spray ..... 5 milliohms
After life (rotational) tests ..... 10 milliohms

TORQUE (stops)

Single shaft switches containing stops shall withstand a torque of 50 pound-inches applied to the shaft against the stops in clockwise and counterclockwise directions.

TABLE IV—ROTATIONAL - TORQUE LIMITS

Temperature	Torque (lb. - in.)		
		5 sections and less	Over 5 to 10 sections
	Minimum	Maximum	Maximum
Room	2	6	16
Minimum	2	8	20

INSULATION RESISTANCE ..... Per MIL-S-3786

TEMPERATURE RANGE ..... –65°C to + 125°C

VOLTAGE BREAKDOWN ..... The applicable test voltage specified in table VI shall be applied between the specified switch elements, except test voltage will be reduced to 1000 volts, r.m.s. after life test.

TABLE VI—DIELECTRIC - TEST VOLTAGES

Altitude	Test Voltage
At atmospheric pressure	(Volts, r.m.s) 1500

VIBRATION 10-2000 cps per MIL-S-3786

SALT SPRAY 48 hours per MIL-S-3786

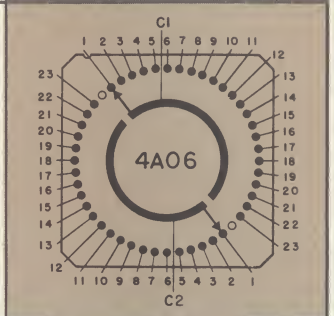
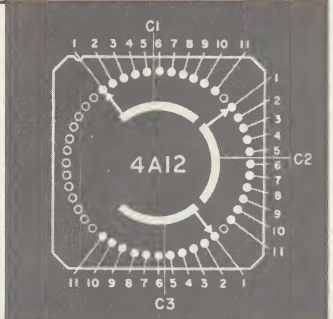
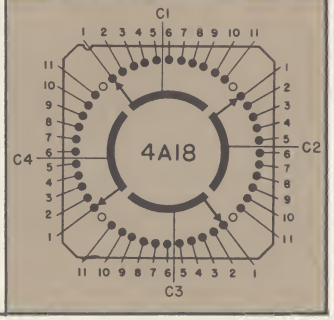
SHOCK High impact per MIL-S-3786

THERMAL SHOCK MIL-S-3786

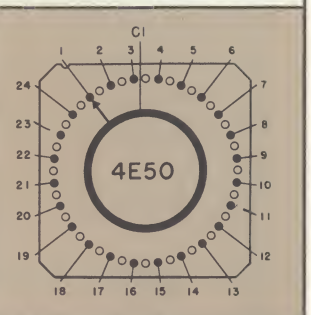
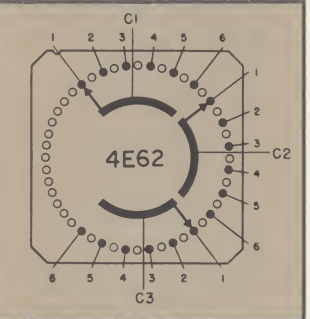
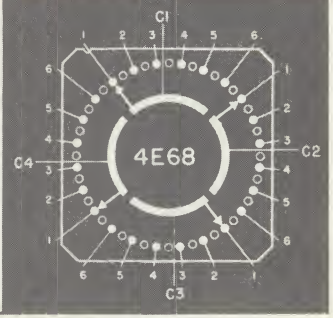
SEE SHALLCROSS ORDER CODE (PAGE 12)

SERIES 4 ORDERING CHARTS

SHORTING SWITCHES (MAKE BEFORE BREAK)

	SHALL CROSS CODE	INDEXING ANGLE	MAXIMUM POSITION PER POLE (With Stops)	MAXIMUM POSITION PER POLE (No Stops)	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
1 POLE PER DECK	4A00	7½°	47	48	15	
2 POLES PER DECK	4A06	7½°	23	CONTINUOUS ROTATION NOT AVAILABLE	10	
3 POLES PER DECK	4A12	7½°	11	CONTINUOUS ROTATION NOT AVAILABLE	7	
4 POLES PER DECK	4A18	7½°	11	CONTINUOUS ROTATION NOT AVAILABLE	6	

NON SHORTING SWITCHES (BREAK BEFORE MAKE)

	SHALL CROSS CODE	INDEXING ANGLE	MAXIMUM POSITION PER POLE (With Stops)	MAXIMUM POSITION PER POLE (No Stops)	MAXIMUM DECKS	DECK CONFIGURATION (VIEWED FROM MOUNTING PLATE)
1 POLE PER DECK	4E50	15°	24	24	15	
2 POLES PER DECK	4E56	15°	12	CONTINUOUS ROTATION NOT AVAILABLE	10	
3 POLES PER DECK	4E62	15°	6	CONTINUOUS ROTATION NOT AVAILABLE	7	
4 POLES PER DECK	4E68	15°	6	CONTINUOUS ROTATION NOT AVAILABLE	6	

SEE SHALLCROSS ORDER CODE (PAGE 12)

January 1, 1966

SHALLCROSS

SERIES 1 ROTARY SWITCH

NET PRICE LIST

PS-44B

	TYPES:	1J04 1J54	1J06 1J56	(2 - 6 Positions/Pole)			
TOTAL POLES	**1 - 9**	**10 - 24**	**25 - 49**	**50 - 99**	**100 - 249**	**250 - 499**	**500 - Up**
1	$ 5.90	$ 4.70	$ 4.05	$ 3.55	$ 3.05	$ 2.85	$ 2.70
2	6.75	5.55	4.85	4.25	3.80	3.60	3.40
3	7.70	6.50	5.60	5.25	4.70	4.40	4.20
4	8.50	7.60	6.80	6.25	5.65	5.30	5.05
5	9.95	9.00	8.10	7.45	6.75	6.30	6.00
6	11.45	10.40	9.40	8.65	7.85	7.30	6.95
7	12.95	11.80	10.70	9.85	8.95	8.30	7.90
8	14.45	13.20	12.00	11.05	10.05	9.30	8.85
9	15.95	14.60	13.30	12.25	11.15	10.30	9.80
10	17.45	16.00	14.60	13.45	12.25	11.30	10.75
Add to 10 pole price for each additional pole up to 20.	1.50	1.40	1.30	1.20	1.10	1.00	.95

	TYPES:	1J00 1J50	1J02 1J52	(2 - 12 Positions/Pole)			
TOTAL POLES	**1 - 9**	**10 - 24**	**25 - 49**	**50 - 99**	**100 - 249**	**250 - 499**	**500 - Up**
1	6.50	5.40	4.60	4.30	4.00	3.85	3.70
2	8.00	6.75	5.85	5.50	5.30	5.15	5.00
3	10.00	8.20	7.40	7.15	6.90	6.80	6.70
4	12.00	10.75	9.90	9.40	9.05	8.75	8.55
5	14.00	13.10	12.10	11.45	11.00	10.65	10.40
6	16.50	15.45	14.30	13.50	12.95	12.55	12.25
7	19.00	17.80	16.50	15.55	14.90	14.45	14.10
8	21.50	20.15	18.70	17.60	16.85	16.35	15.95
9	24.00	22.50	20.90	19.65	18.80	18.25	17.80
10	26.50	24.85	23.10	21.70	20.75	20.15	19.65

SERIES 1 STANDARD OPTION NET PRICE LIST

	SWITCH QUANTITY						
ADD-ON PER SWITCH	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
Flatted shafts (per flat)	.90	.75	.65	.60	.55	.50	.45
Special shaft length	.50	.45	.40	.35	.30	.25	.20
Shaft seal	3.25	2.15	1.75	1.60	1.45	1.35	1.25

	SWITCH QUANTITY						
ADD-ON PER DECK	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
Gold-Plated (.0001") current carrying parts	.50	.45	.40	.38	.35	.33	.31

SHALLCROSS MANUFACTURING COMPANY

PRESTON STREET — SELMA, NORTH CAROLINA 27576

TWX: 919-770-7839 TELEPHONE 919-965-2341

January 1, 1966

SHALLCROSS
SERIES 2 ROTARY SWITCH
NET PRICE LIST

PS-41B

ONE POLE PER DECK
Types 2E00, 2C00, 2J00, 2H00, 2H50, 2J50

	SWITCH QUANTITY						
NO. DECKS	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$ 9.75	$ 8.85	$ 7.10	$ 6.45	$ 5.90	$ 5.40	$ 5.10
2	14.25	12.90	10.35	9.40	8.65	7.85	7.50
3	18.75	16.95	13.65	12.40	11.35	10.35	9.85
4	25.00	21.00	16.90	15.35	14.10	12.80	12.25
5	30.55	25.05	20.15	18.35	16.80	15.30	14.70
6	35.50	29.10	23.45	21.30	19.55	17.75	16.95
7	47.00	38.55	31.05	28.20	25.85	23.50	21.65
8	51.95	42.60	34.30	31.20	28.60	26.00	24.95
9	56.90	46.65	37.55	34.15	31.30	28.45	26.20
10	61.85	50.70	40.80	37.10	34.05	30.95	28.45
11 Up	Add to 10 deck price for each additional deck:						
	5.00	4.50	4.00	3.50	3.25	3.10	3.00

TWO POLES PER DECK
Types 2C06, 2E06, 2H06, 2J06, 2H56, 2J56

	SWITCH QUANTITY						
NO. DECKS	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$10.50	$ 9.50	$ 7.65	$ 6.95	$ 6.35	$ 5.80	$ 5.30
2	15.50	14.00	11.25	10.25	9.40	8.55	7.85
3	20.50	18.50	14.90	13.55	12.40	11.30	10.40
4	28.05	23.00	18.50	16.85	15.45	14.05	12.90
5	33.55	27.50	22.15	20.15	18.45	16.80	15.45
6	39.05	32.05	25.80	23.45	21.50	19.55	17.95
7	51.15	41.95	33.75	30.70	28.15	25.60	23.50
8	56.65	46.45	37.40	34.00	31.15	28.35	26.05
9	62.15	51.00	41.05	37.30	34.20	31.10	28.60
10	67.65	55.50	44.65	40.60	37.20	33.85	31.10
11	81.95	67.20	54.10	49.20	45.10	41.00	37.70
12	87.95	72.45	58.60	53.20	48.85	44.60	41.15

THREE POLES PER DECK
Types 2C12, 2E12, 2H12, 2J12, 2H62, 2J62

	SWITCH QUANTITY						
NO. DECKS	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$11.50	$10.20	$ 8.20	$ 7.45	$ 6.80	$ 6.20	$ 5.80
2	17.25	15.15	12.20	11.10	10.15	9.25	8.70
3	22.75	20.10	16.20	14.75	13.50	12.30	11.50
4	30.55	25.05	20.20	18.40	16.85	15.35	14.25
5	36.60	30.00	24.20	22.05	20.20	18.40	17.20
6	42.65	34.95	28.20	25.70	23.55	21.45	20.25
7	55.30	45.35	36.50	33.20	30.40	27.65	25.95
8	61.35	50.30	40.50	36.85	33.75	30.70	29.25

Supersedes PS-41A, Dated 12-1-64

	FOUR POLES PER DECK Types 2C18, 2E18, 2H18, 2J18, 2H68, 2J68						
	SWITCH QUANTITY						
NO. DECKS	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$12.95	$10.85	$ 8.70	$ 7.95	$ 7.25	$ 6.60	$ 6.25
2	18.75	16.25	13.05	11.95	10.90	9.90	9.30
3	25.00	21.65	17.40	15.95	14.55	13.20	12.70
4	33.00	27.05	21.75	19.95	18.20	16.50	15.85
5	39.60	32.45	26.10	23.95	21.85	19.80	18.95
6	46.20	37.85	30.45	27.95	25.50	23.10	21.95

SERIES 2 STANDARD OPTION NET PRICE LIST

	SWITCH QUANTITY						
ADD ON PER SWITCH	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
FLATTED SHAFTS (Per Flat)	$ .90	$ .75	$ .65	$ .60	$ .55	$ .50	$ .45
SPECIAL SHAFT LENGTH	1.00	.75	.55	.45	.40	.35	.30
HIGH VOLTAGE DESIGN	2.00	1.60	1.20	1.00	.85	.75	.65
PRINTED CIRCUIT DESIGN	3.00	2.50	2.00	1.75	1.50	1.35	1.20
SHAFT SEAL	3.25	2.15	1.75	1.60	1.45	1.35	1.25
SPRING RETURN	7.00	5.00	4.00	3.60	3.30	3.00	2.80
CONCENTRIC SHAFT (Add to sum of individual switch prices.)	12.50	9.50	8.50	7.50	6.75	6.25	5.75

	SWITCH QUANTITY						
ADD ON PER DECK	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
DUST COVERS	$1.15	$ .95	$ .85	$ .75	$ .70	$ .65	$ .60
CLUSTER ARM (Silver)	4.50	3.50	2.95	2.50	2.25	2.10	1.95
CLUSTER ARM (Gold)	5.85	5.20	4.35	3.95	3.75	3.60	3.45
GOLD PLATED (.0001") current carrying parts.	3.00	2.50	2.00	1.80	1.50	1.40	1.30
MIL-S-3786 OPTION (Tinned terminals, numbered contacts, special marking.)	1.50	1.25	1.00	.75	.55	.45	.40
NUMBERED CONTACTS *	.35	.25	.20	.15	.10	.08	.06
SPECIAL SPACERS	.50	.45	.40	.35	.30	.25	.20

* Included in MIL-S-3786 option automatically but available separately.

SHALLCROSS MANUFACTURING COMPANY

PRESTON STREET — SELMA, NORTH CAROLINA 27576

TWX: 919-770-7839 TELEPHONE 919-965-2341

December 1, 1964

SHALLCROSS

SERIES 4 ROTARY SWITCH

NET PRICE LIST

PS-42A

ONE POLE PER DECK
Types 4A00, 4E50

NO. DECKS	SWITCH QUANTITY 1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$14.00	$12.50	$10.75	$ 9.75	$ 9.20	$ 8.90	$ 8.70
2	20.50	17.50	16.00	14.50	13.75	13.25	13.00
3	27.50	24.00	21.00	18.50	17.75	17.25	17.00
4	34.50	30.00	27.50	25.00	24.00	23.55	22.75
5	41.50	35.00	32.00	30.00	28.50	27.75	27.00
6	48.50	41.00	36.00	35.00	33.00	32.25	31.75
7	55.50	46.00	41.00	40.00	38.00	37.00	36.50
8	62.50	51.00	46.00	45.00	44.00	42.50	41.75
9	69.50	58.00	54.00	50.00	48.00	46.50	45.75
10	76.50	68.00	62.00	55.00	53.00	52.00	51.50
11	86.50	77.00	70.00	62.00	59.50	58.25	57.50
12 Up	Add to 11 deck price for each additional deck:						
	10.00	9.00	8.00	7.00	6.50	6.25	6.00

TWO POLES PER DECK
Types 4A06, 4E56

NO. DECKS	SWITCH QUANTITY 1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$15.00	$13.25	$11.35	$10.25	$ 9.65	$ 9.30	$ 9.05
2	22.50	19.00	17.20	15.50	14.65	14.05	13.70
3	30.50	26.25	22.80	20.00	19.10	18.45	18.05
4	38.50	33.00	29.90	27.00	25.70	25.15	24.15
5	46.50	38.75	35.00	32.50	30.75	29.75	28.75
6	54.50	45.50	39.60	38.00	35.70	34.65	33.85
7	62.50	51.25	45.20	43.50	41.15	39.80	38.95
8	70.50	57.00	50.80	49.00	47.60	45.70	44.55
9	78.50	64.75	59.40	54.50	52.05	50.10	48.90
10	86.50	75.50	68.00	60.00	57.50	56.00	55.00

THREE POLES PER DECK
Types 4A12, 4E62

NO. DECKS	SWITCH QUANTITY 1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$16.00	$14.00	$11.95	$10.75	$10.10	$ 9.70	$ 9.40
2	24.50	20.50	18.40	17.50	15.55	14.85	14.40
3	33.50	28.50	24.60	21.50	20.45	19.65	19.10
4	42.50	36.00	32.30	29.00	27.60	26.75	25.55
5	51.50	42.50	38.00	35.00	33.00	31.75	30.50
6	60.50	50.00	43.20	41.00	38.40	37.05	35.95
7	69.50	56.50	49.40	47.00	44.30	42.60	41.40

Supersedes PS-42, Dated 10-17-63

	FOUR POLES PER DECK Types 4A18, 4E68						
	SWITCH QUANTITY						
NO. DECKS	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
1	$17.00	$14.75	$12.55	$11.25	$10.55	$10.10	$ 9.75
2	26.50	22.00	19.60	17.50	16.45	15.65	15.10
3	36.50	30.75	26.40	23.00	21.80	20.85	20.15
4	46.50	39.00	34.70	31.00	29.40	28.35	26.95
5	56.50	46.25	41.00	37.50	35.25	33.75	32.25
6	66.50	54.50	46.80	44.00	41.10	39.45	38.05

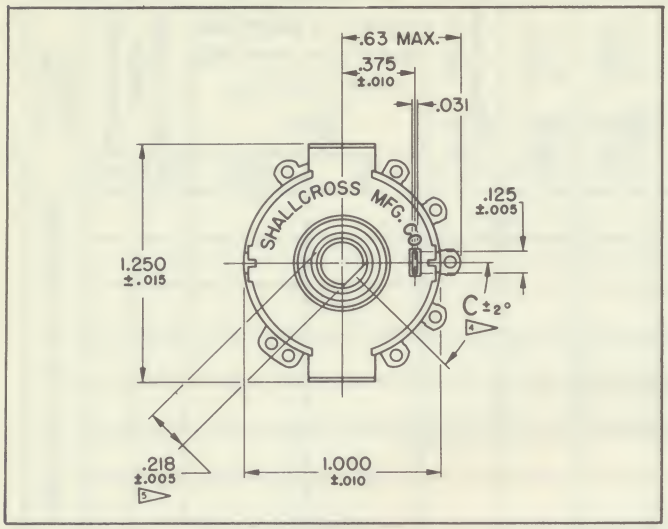
SERIES 4 STANDARD OPTION NET PRICE LIST

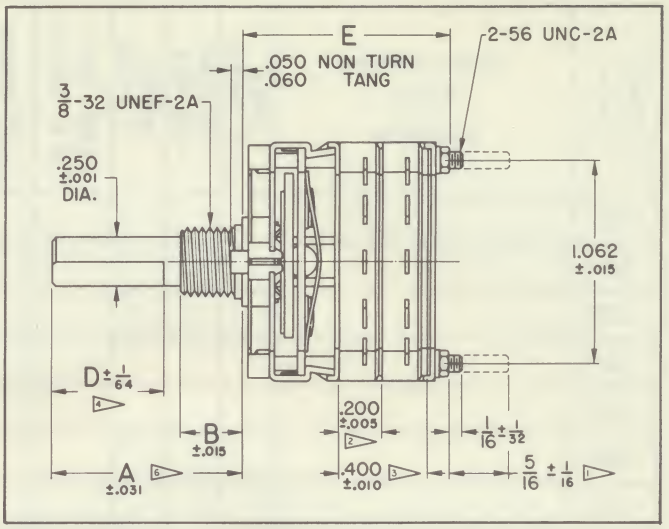
	SWITCH QUANTITY						
ADD ON PER SWITCH	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
FLATTED SHAFTS (Per Flat)	$ .90	$ .75	$ .65	$ .60	$ .55	$ .50	$ .45
SPECIAL SHAFT LENGTH	1.00	.75	.55	.45	.40	.30	.25

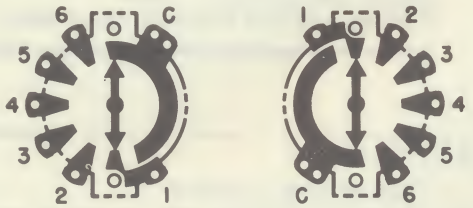
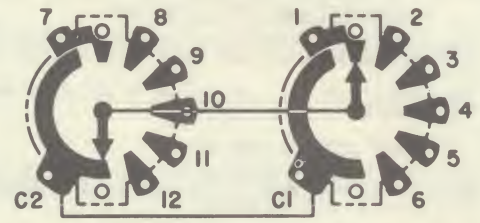
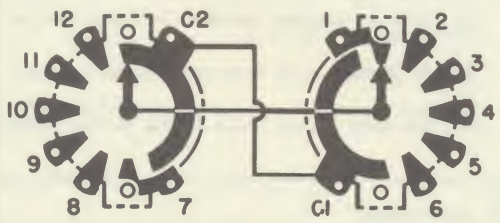
	SWITCH QUANTITY						
ADD ON PER DECK	1 - 9	10 - 24	25 - 49	50 - 99	100 - 249	250 - 499	500 - Up
NUMBERED CONTACTS *	$ .40	$ .30	$ .25	$ .20	$ .15	$ .11	$ .08
MIL-S-3786 OPTION (tinned terminals, numbered contacts, special marking.)	1.75	1.50	1.25	1.00	.75	.60	.55
GOLD PLATED (.001") current carrying parts.	4.00	3.50	3.00	2.60	2.20	2.00	1.90

* Included in MIL-S-3786 option automatically but available separately.

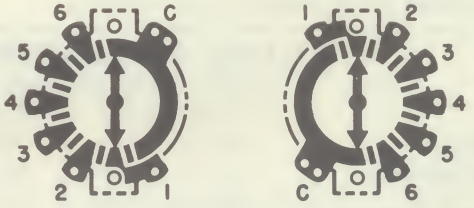
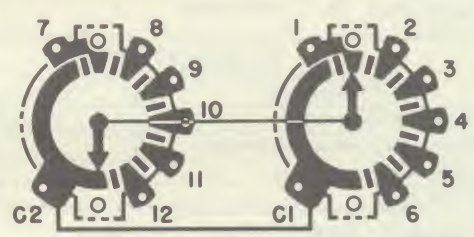
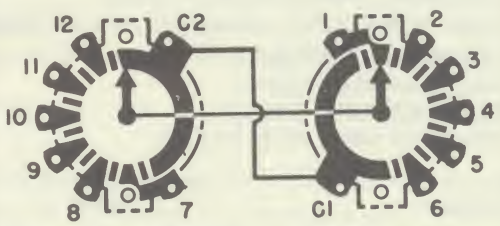
SHALLCROSS | SERIES 1 | ROTARY SWITCH SPECIFICATION SHEET #5 (COMMERCIAL)





SHALLCROSS SERIES	TERMINAL LOCATIONS AND WAFER CONFIGURATIONS VIEWED FROM MTG. PLATE WITH MOVING CONTACT IN #1 POSITION AND MTG. TANG AT 90° (3 O'CLOCK)
1J04	 EVEN AND ODD WAFERS
1J06	 EVEN WAFERS ODD WAFERS
1J00	 EVEN WAFERS ODD WAFERS
1J02	 EVEN WAFERS ODD WAFERS

SHORTING SWITCHES

SHALLCROSS SERIES	TERMINAL LOCATIONS AND WAFER CONFIGURATIONS VIEWED FROM MTG. PLATE WITH MOVING CONTACT IN #1 POSITION AND MTG. TANG AT 90° (3 O'CLOCK)
1J54	 EVEN AND ODD WAFERS
1J56	 EVEN WAFERS ODD WAFERS
1J50	 EVEN WAFERS ODD WAFERS
1J52	 EVEN WAFERS ODD WAFERS

NONSHORTING SWITCHES

CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF POLES	SHAFT LENGTH ⑥ DIM. "A"	BUSHING LENGTH ⑦ DIM. "B"	FLAT ANGLE ④ DIM. "C"	FLAT LENGTH ④ DIM. "D"	BACK PANEL DEPTH ③ DIM. "E"	INDICATE S (SHORTING) OR NS (NON SHORTING) FOR EACH POLE ⑧		GOLD PLATED CURRENT CARRYING PARTS		TERMINAL LOCATIONS
										S	NS	YES	NO	
-001														AS SHOWN AT LOWER LEFT FOR TYPE SPECIFIED
-002														
-003														
-004														
-005														
-006														
-007														
-008														
-009														
-010														

RATINGS (COMMERCIAL)

LOAD (BREAKING) VS. LIFE (CYCLES)	
LOAD	LIFE
No Load	50,000
100 VDC — .25A	50,000
125 VAC — .25A	50,000
30 VDC — .5A	50,000

CURRENT CAPACITY —
10 Amps (For temperature rise < 30°C)

VOLTAGE BREAKDOWN
—55°C To +85°C, 50% RH, Sea Level

	Initial (Minimum)	End of Life (Minimum)
Between Poles	2000V RMS (60 Cycles)	1500V RMS (60 Cycles)
Between contacts	1000V RMS (60 Cycles)	800V RMS (60 Cycles)
To Ground	2000V RMS (60 Cycles)	1500V RMS (60 Cycles)

INSULATION RESISTANCE
(room conditions)
Initial — > 10^{12} Ohms
End of Life— > 10^{10} Ohms

CAPACITANCE

Points of Measurement	Capacitance
Between adjacent contacts	.5 uuf (Max.)
Between contact and common terminal	.9 uuf (Max.)
Between common and frame	10.0 uuf (Max.)
Between poles	5.0 uuf (Max.)

CONTACT RESISTANCE (INITIAL)
2—6 Pos/Pole Switch Types—.0025 Ohm Max.
7—12 Pos/Pole Switch Types—.0035 Ohm Max.
THERMAL EMF—1u Volt/°C (Max.)
STOP STRENGTH—Withstand 25 in/lb Rotational Force
TERMINAL STRENGTH—Withstand 5 lb. pull three mutually perpendicular planes
TEMPERATURE RANGE— —40°C to +85°C (Where all commercial rating are to be met)

DRAWN _____ DATE _____
CHECKED _____ _____
APPROVED _____ _____

MATERIALS

STOP RETAINER, MTG. PLATE, DETENT PARTS, COVER PLATE, WASHERS, STOP PIN, SCREWS, NUTS, SHAFT, ROTOR GUIDE — stainless steel (passivated)
CONTACT ARMS — Beryllium copper (silver plated)
ROTOR CONTACTS (MOVING), STATOR CONTACTS (STATIONARY) AND INTEGRAL TERMINALS — silver alloy
ROTOR INSULATOR — Lexan
STATOR — Diallyl Phthalate (glass filled)

NOTES

① Add on dimension to provide rear support accommodations for 11 or more wafers only.

BACK OF PANEL DIMENSION "E"

② See back of panel dimension chart for wafer/pole and exact back panel dimension per switch type.

③ See back panel dimension chart for wafer/pole and exact back panel dimension per switch type.

SHAFT FLAT DIM. "C" & DIM. "D"

④ Flatted shafts not supplied unless specified. Minimum flat length 3/16". Maximum flat length=shaft length - (bushing length +3/32").

⑤ Flatted shafts when specified will be cut to the standard dimension shown (optional dimensions available).

SHAFT LENGTHS DIM. "A"

⑥ Shaft lengths are measured from end of shaft to mounting surface. Standard shaft length is one inch ± .031. Optional shaft lengths from 5/8" to 2" are available.

STANDARD MTG. BUSHING LENGTHS DIM. "B"

⑦ 5/16 1/2 3/8 3/4
(Optional dimensions available).

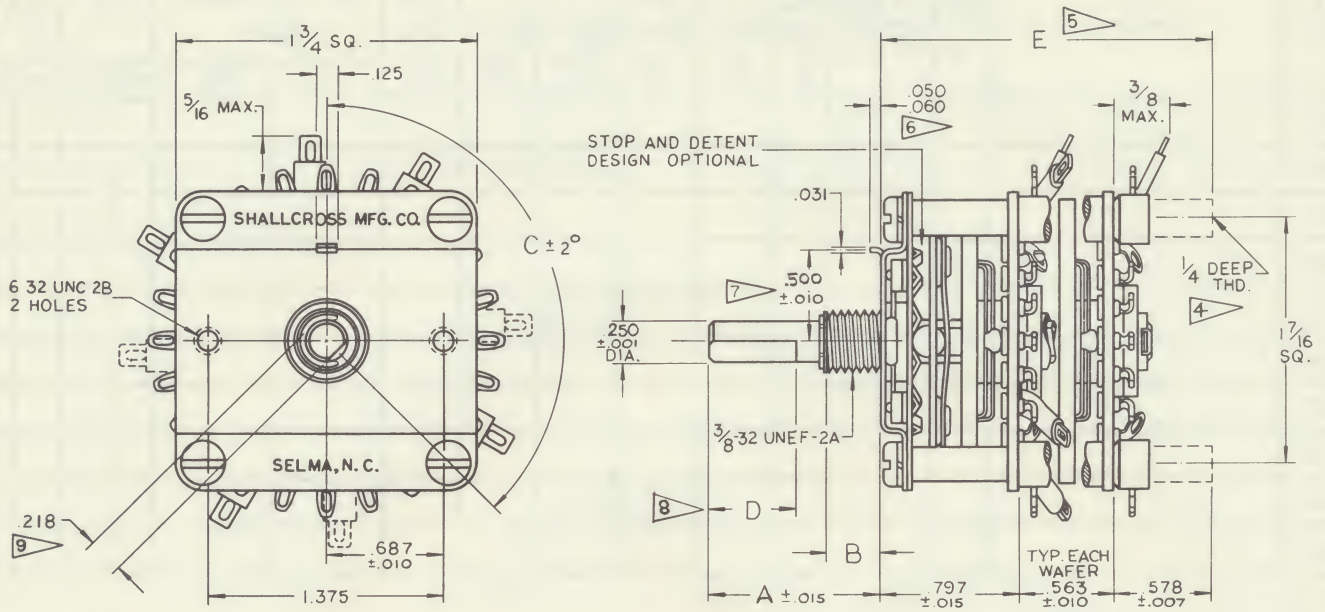
⑧ Poles are numbered sequentially beginning with pole nearest mounting plate.

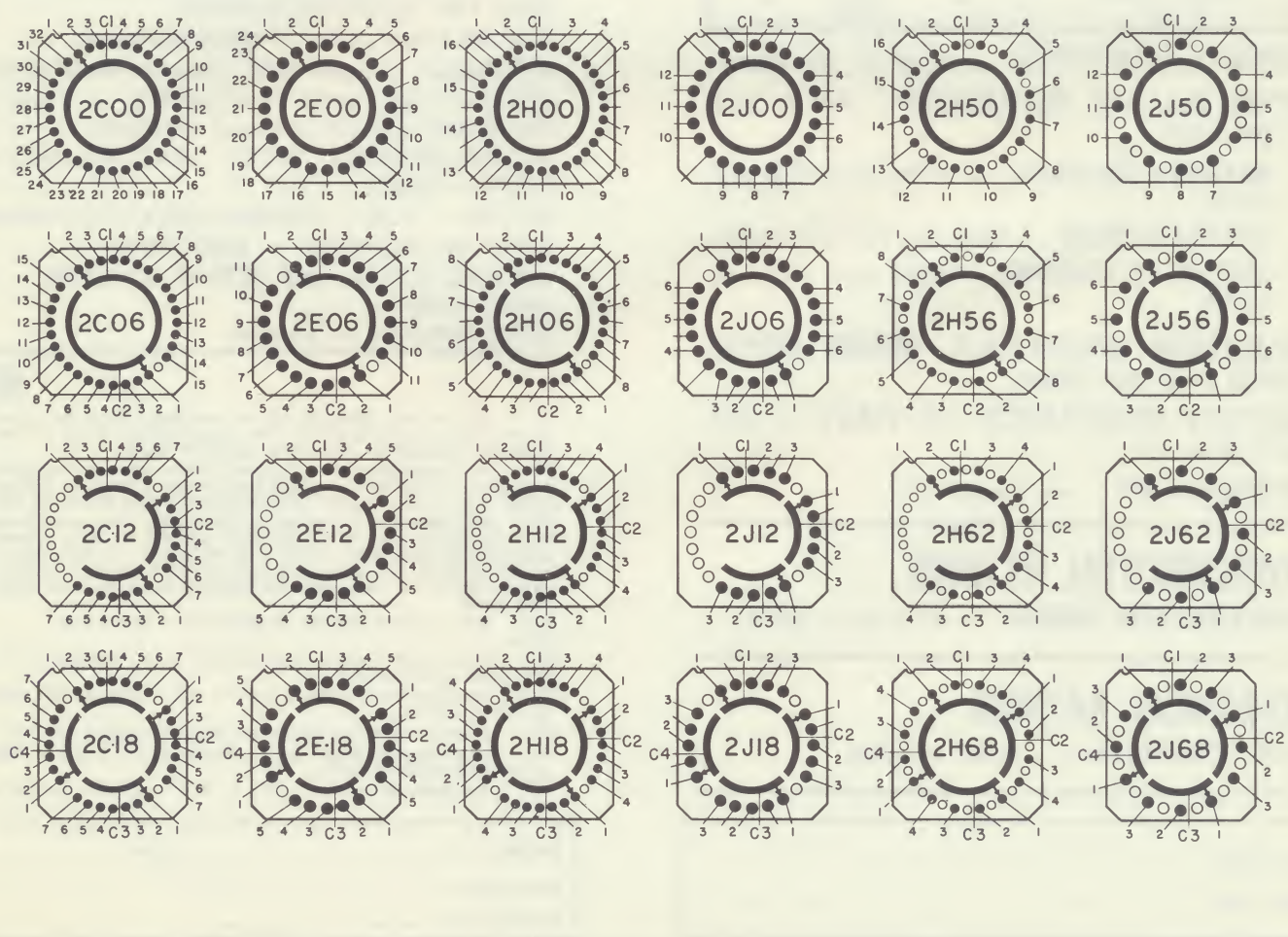
⑨ All dimension are in inches with tolerances as shown.

⑩ Load life ratings apply up to 10 poles (2-6 pos./pole) or 5 poles (7-12 pos./pole). Life may require derating for larger number of poles.

CUSTOMER _____
PART NO. _____

SHALLCROSS SERIES 2 ROTARY SWITCH SPECIFICATION SHEET #1 (COMMERCIAL)





CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF DECKS	POLES PER DECK 1, 2, 3 OR 4	SHAFT LENGTH [2] DIM. "A"	BUSHING LENGTH [2] DIM. "B"	FLAT ANGLE [2] DIM. "C"	FLAT LENGTH [2] DIM. "D"	BACK PANEL DEPTH [5] DIM. "E"	INDICATE S (SHORTING) OR NS (NON SHORTING) FOR EACH DECK [3]		DUST COVER		GOLD PLATED CURRENT CARRYING PARTS		TERMINAL LOCATIONS
											S	NS	YES	NO	YES	NO	
-001																	AS SHOWN AT LOWER LEFT FOR TYPE SPECIFIED
-002																	
-003																	
-004																	
-005																	
-006																	
-007																	
-008																	
-009																	
-010																	

ELECTRICAL RATINGS (COMMERCIAL)

POWER (BREAKING)

LOAD (BREAKING) VS. LIFE (CYCLES) [1]	
LOAD	LIFE
250 VDC .1 AMP	50,000
100 VDC .5 AMP	20,000
30 VDC 2 AMPS	20,000
120 VAC 2 AMPS	10,000
NO LOAD	100,000

CURRENT (CARRYING) — 10 Amps. Maximum

INITIAL VOLTAGE BREAKDOWN (25°C, 50% RH, sea level)

BETWEEN CONTACTS — 1500 volts RMS (60 cycles)

BETWEEN POLES — 2000 volts RMS (60 cycles)

CIRCUIT TO GROUND — 3000 volts RMS (60 cycles)

INSULATION RESISTANCE (ROOM CONDITIONS) — $> 10^{14}$ OHMS

CONTACT RESISTANCE (INITIAL) — .002 OHMS Maximum

THERMAL EMF — $< 1\ \mu$ volt/°C

ENVIRONMENTAL RATINGS

TEMPERATURE RANGE — 40°C to + 85°C

MECHANICAL RATINGS

STOP STRENGTH — > 50 inch/lbs.

CUSTOMER _____

PART NO. _____

MATERIALS

(SUBJECT TO CHANGE)

DETENT SPRING AND BALLS, SHAFT, MTG. PLATE, STOPS, BUSHING, MTG. HARDWARE, DETENT PLATE, BALL RETAINER, — passivated stainless steel

WIPER ARMS — solid spring silver alloy (gold plate optional)

CONTACTS, COLLECTOR RINGS, SEGMENTS — solid silver alloy (gold plate optional)

STATOR (deck plate) — epoxy fibreglass

TERMINALS (integral with contact)—solid silver alloy

COMMON AND CORNER TERMINAL — copper alloy (tin dipped and teflon sleeve insulated)

ROTOR BEARING, ROTOR SPACERS, INSULATOR CUPS — nylon

ROTOR — diallyl phthalate (glass fibre reinforced)

STOP PIN RETAINER — nickel silver

SCREWS, STUDS AND DETENT SPACERS — nickel plated brass

DECK SPACERS — steatite

NOTES

[1] Life vs. load ratings apply for switches with up to 10 decks or 24 poles (whichever is greater). Life specifications must be derated for switches with greater number of decks or poles.

[2] All dimensions are in inches unless otherwise specified. Tolerances are ±1/64″ for fractional dimensions, ±.005″ for decimal dimensions, and ±2° for angular specifications, unless otherwise specified.

[3] All sections operated by one shaft must have same throw (indexing). Maximum number of positions for one shaft is determined by section with most poles. 22½° and 30° throw switches must have adjacent terminals (unnumbered to numbered) connected to obtain shorting action. Decks are numbered sequentially beginning with deck nearest mtg. plate.

[4] Rear support spacers supplied on 6 decks and over.

[5] Rear support spacers are included in "E" dimension for switches of 6 decks or more only.

[6] Standard tang length is .050″ to .060″. Optional tang length .110″ to .120″ available.

[7] Standard distance from shaft center to tang center .500″ ±.010″.

[8] Minimum flat length 3/16″. Maximum flat length = shaft length —(bushing length +3/32″).

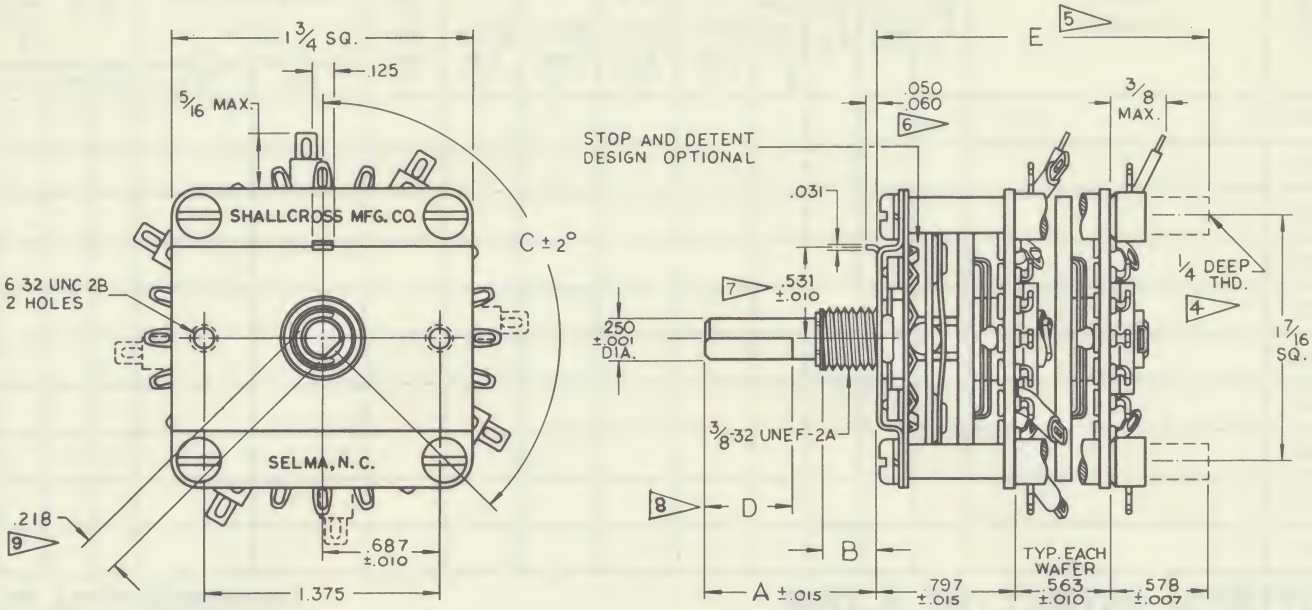
[9] Standard dimension .218″ ± .005″ (optional dimensions available).

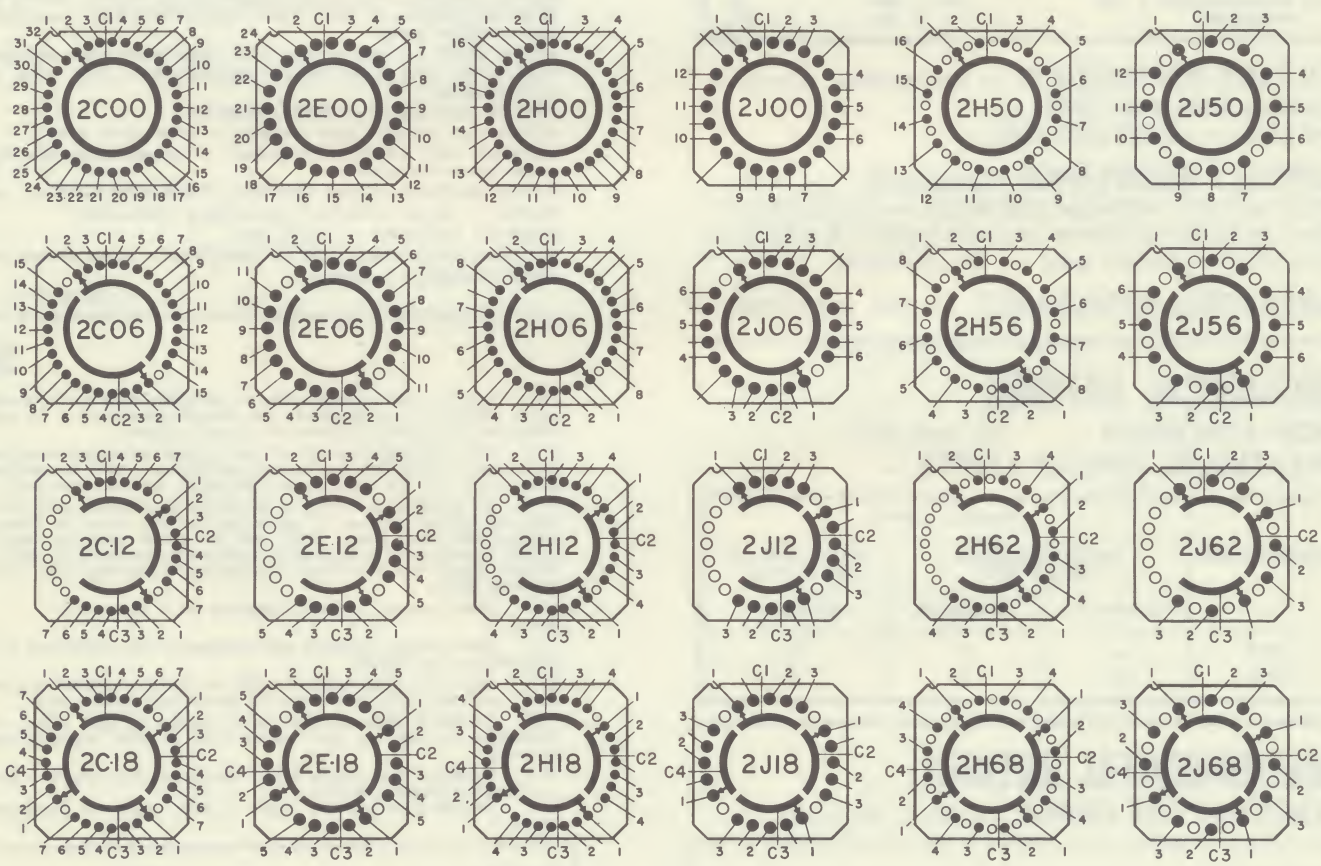
DRAWN _____ DATE _____

CHECKED _____ _____

APPROVED _____ _____

SHALLCROSS | SERIES 2 | ROTARY SWITCH SPECIFICATION SHEET #2 (MIL-S-3786 ST





YLE SR14)

CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF DECKS	POLES PER DECK 1, 2, 3 OR 4	SHAFT LENGTH [2] DIM. "A"	BUSHING LENGTH [2] DIM. "B"	FLAT ANGLE [2] DIM. "C"	FLAT LENGTH [2] DIM. "D"	BACK PANEL DEPTH [5] DIM. "E"	INDICATE S (SHORTING) OR NS (NON SHORTING) FOR EACH DECK [3]		DUST COVER		GOLD PLATED CURRENT CARRYING PARTS		TERMINAL LOCATIONS
											S	NS	YES	NO	YES	NO	
-001																	AS SHOWN AT LOWER LEFT FOR TYPE SPECIFIED
-002																	
-003																	
-004																	
-005																	
-006																	
-007																	
-008																	
-009																	
-010																	

ELECTRICAL RATINGS (MIL-S-3786 STYLE SR14)

POWER (50,000 cycles rotational life at +125°C)

[1]	INDUCTIVE LOAD (2.8 HENRIES)		RESISTIVE LOADS (A.C. OR D.C.)	
	MILLI-AMPERES	VOLTS D.C.	MILLI-AMPERES	VOLTS
AT ATMOSPHERIC PRESSURE	50	30	500 50	30 300

VOLTAGE BREAKDOWN (at atmospheric pressure)
Initial — 1500 volts RMS
End of life — 1000 volts RMS

CONTACT RESISTANCE (Maximum)
Initial and after vibration and shock — 5 milliohms
After moisture resistance and salt spray—5 milliohms
After life (rotational) tests — 10 milliohms

INSULATION RESISTANCE — Per Mil-S-3786

MECHANICAL RATINGS

STOP STRENGTH — 50 inch/lbs.

ROTATIONAL TORQUE LIMITS —

TEMPERATURE	TORQUE (LB-IN.)		
	UP TO 5 SECTIONS OR 10 POLES		UP TO 10 DECKS OR 15 POLES
	MINIMUM	MAXIMUM	MAXIMUM
+ 25°C	1½	6	10
— 65°C	1½	8	13

ENVIRONMENTAL RATINGS

TEMPERATURE RANGE — 65°C to +125°C

CUSTOMER _____

PART NO. _____

ENVIRONMENTAL RATINGS

VIBRATION — 10-2000 cps per Mil-S-3786

SHOCK — High impact per Mil-S-3786

SALT SPRAY — 48 hours per Mil-S-3786

THERMAL SHOCK — Per Mil-S-3786

MATERIALS

DETENT SPRING AND BALLS, SHAFT, MTG. PLATE, STOPS, BUSHING, MTG. HARDWARE, DETENT PLATE, BALL RETAINER, – passivated 18-8 stainless steel

WIPER ARMS — solid spring silver alloy (gold plate optional)

CONTACTS, COLLECTOR RINGS, SEGMENTS — solid silver alloy (gold plate optional)

STATOR (deck plate) — epoxy fibreglass

TERMINALS (integral with contact) — solid silver alloy

COMMON AND CORNER TERMINAL — copper alloy (tin dipped and teflon sleeve insulated)

ROTOR BEARING, ROTOR SPACERS INSULATOR CUPS — nylon

ROTOR — diallyl phthalate (glass fibre reinforced)

STOP PIN RETAINER — nickel silver

SCREWS, STUDS AND DETENT SPACERS — nickel plated brass

DECK SPACERS — steatite

(SUBJECT TO CHANGE)

NOTES

[1] Life vs. load ratings apply for switches with up to 10 decks or 24 poles (whichever is greater). Life specifications must be derated for switches with greater number of decks or poles.

[2] All dimensions are in inches unless otherwise specified. Tolerances are ±1/64″ for fractional dimensions, ±.005″ for decimal dimensions, and ±2° for angular specifications (unless otherwise specified).

[3] All sections operated by one shaft must have same throw (indexing). Maximum number of positions for one shaft is determined by section with most poles. 22½° and 30° throw switches must have adjacent terminals (unnumbered to numbered) connected to obtain shorting action. Decks are numbered sequentially beginning with deck nearest the mtg. plate.

[4] Rear support spacers supplied on 6 decks and over.

[5] Rear support spacers are included in "E" dimension for switches of 6 decks or more only.

[6] Standard tang length is .050″ to .060″. Optional length .110″ to .120″ available with .500″ spacing from shaft center only.

[7] Standard distance from shaft center to tang center .531″ (this dimension is .500″ ± .010″ when .110″ to .120″ optional tang length is used).

[8] Minimum flat length 3/16″. Maximum flat length = shaft length (bushing length +3/32″).

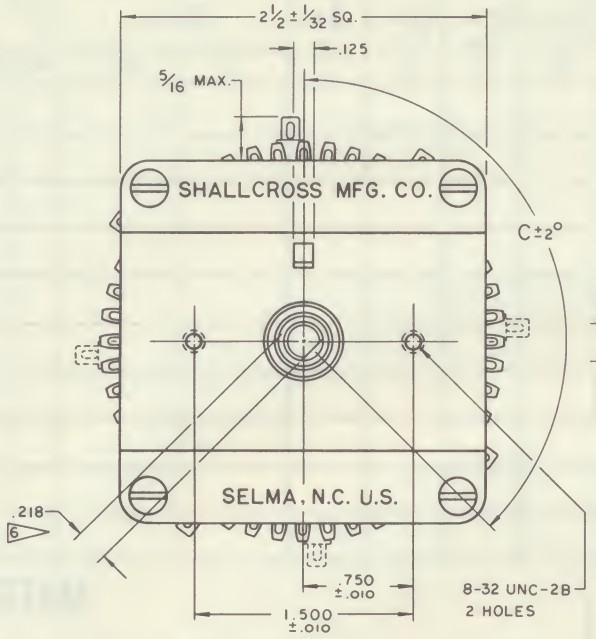
[9] Standard dimension .218″ ±.005″ (optional dimensions available).

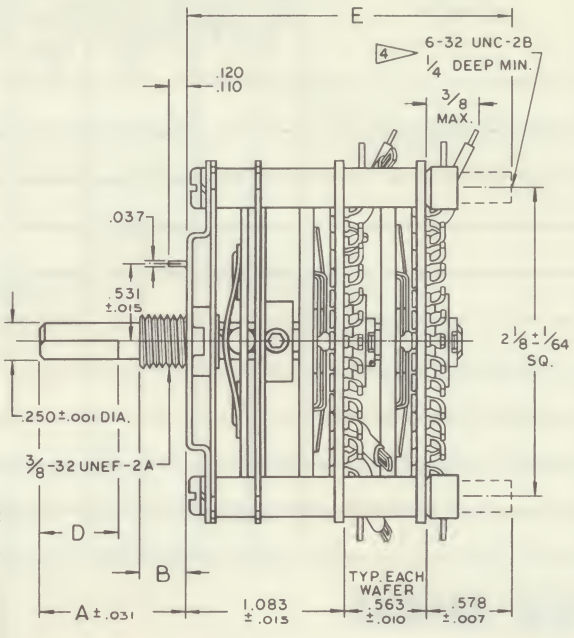
DRAWN _____ DATE _____

CHECKED _____ _____

APPROVED _____ _____

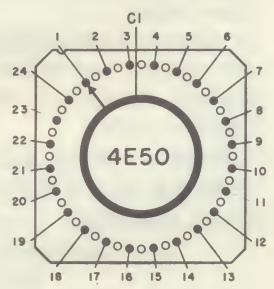
SHALLCROSS SERIES 4 ROTARY SWITCH SPECIFICATION SHEET #3 (COMMERCIAL)

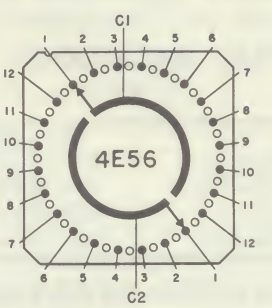


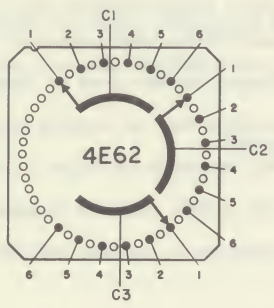


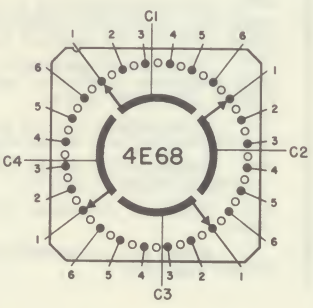
5 Standard dimension .218″ ±.005″ (optional dimensions available).

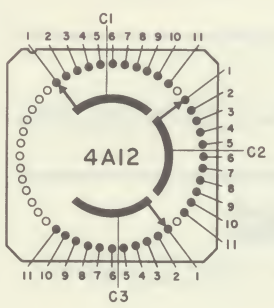
4 Rear support spacers and nylon cups are supplied (and included in E dimension) on 5 decks and over.

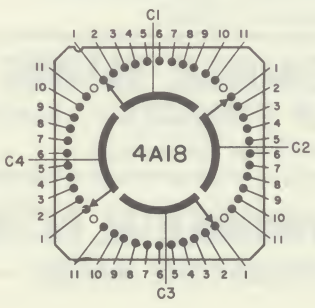












CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF DECKS	POLES PER DECK 1,2,3 OR 4	SHAFT LENGTH [2] DIM. "A"	BUSHING LENGTH [2] DIM. "B"	FLAT ANGLE [2] DIM. "C"	FLAT LENGTH [5] DIM. "D"	BACK PANEL DEPTH [6] DIM. "E"	INDICATE S (SHORTING) OR NS (NON SHORTING) FOR EACH DECK [3]		GOLD PLATED CURRENT CARRYING PARTS		TERMINAL LOCATIONS
											S	NS	YES	NO	
-001															AS SHOWN AT LOWER LEFT FOR TYPE SPECIFIED
-002															
-003															
-004															
-005															
-006															
-007															
-008															
-009															
-010															

ELECTRICAL RATINGS

LOAD (BREAKING) VS. LIFE (CYCLES) [1]	
LOAD	LIFE
0 Volts, 0 AMPS	50,000
10 VDC, 10 AMPS	50,000
30 VDC, 1.0 AMP	50,000
100 VDC, 0.5 AMPS	25,000
120 VAC, 1.0 AMP	10,000
120 VAC, 0.5 AMPS	35,000

CURRENT CARRYING CAPACITY —
10 Amps (For Temperature Rise $< 30°C$)

VOLTAGE BREAKDOWN —
($-55°C$ to $+85°C$, 50% RH, Sea Level)

	INITIAL (MINIMUM)	END OF LIFE (MINIMUM)
BETWEEN POLES	2000 V RMS (60 CYCLES)	1000 V RMS (60 CYCLES)
BETWEEN CONTACTS	1500 V RMS (60 CYCLES)	800 V RMS (60 CYCLES)
TO GROUND	3000 V RMS (60 CYCLES)	2000 V RMS (60 CYCLES)
BETWEEN DECKS	6000 V RMS (60 CYCLES)	4000 V RMS (60 CYCLES)

INSULATION RESISTANCE
(room conditions) $> 10^{12}$

THERMAL EMF — 1μ Volt/°C (Maximum)

CONTACT RESISTANCE — .002 Ohms Maximum (Initial)

MECHANICAL RATINGS

STOP STRENGTH — Withstand 50 In./Lb. Rotational Force (Minimum)

ENVIRONMENTAL RATINGS

TEMPERATURE RANGE — $-55°C$ to $+85°C$

MATERIALS

DETENT SPRING AND BALLS, SHAFT, MTG. PLATE, STOPS, BUSHING, MTG. HARDWARE, DETENT PLATE, BALL RETAINER, STOP PIN RETAINER, DETENT SPACERS — passivated stainless steel

WIPER ARMS — solid spring silver alloy (gold plate optional)

CONTACTS, COLLECTOR RINGS (Segments) — solid silver alloy (gold plate optional)

STATOR (DECK PLATE) — epoxy fiberglass

CONTACT LUGS (INTEGRAL WITH CONTACTS)—solid silver alloy

COMMON AND CORNER TERMINALS — copper alloy (tin dipped and teflon sleeve insulated)

ROTOR BEARING, ROTARY SPACERS, INSULATING CUPS — nylon

ROTOR — diallyl phthalate (glass fibre reinforced)

SCREWS AND STUDS — nickel plated brass

DECK SPACERS — steatite

ALL MATERIALS SUBJECT TO CHANGE WITHOUT NOTICE

NOTES

[1] Life vs. load ratings apply for switches with up to 10 decks or 24 poles (whichever is greater). Life specifications must be derated for switches with greater number of decks or poles.

[2] All dimensions are in inches unless otherwise specified. Tolerances are $\pm 1/64''$ for fractional dimensions, $\pm .005''$ for decimal dimensions, and $\pm 2°$ for angular specifications, unless otherwise specified.

[3] All sections operated by one shaft must have same throw (indexing). Maximum number of positions for one shaft is determined by section with most poles.

[4] Rear support spacers and nylon cups are supplied (and included in E dimension) on 5 decks and over.

[5] Minimum flat length 3/16". Maximum flat length = shaft length —(bushing length +3/32").

[6] Standard dimension .218" $\pm .005''$ (optional dimensions available).

7 Decks are numbered consecutively beginning with deck nearest detent assembly.

DRAWN _____ DATE _____

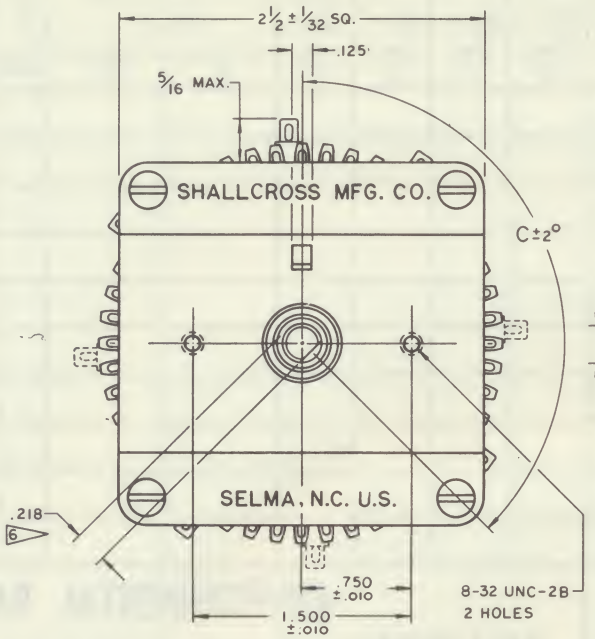
CHECKED _____ _____

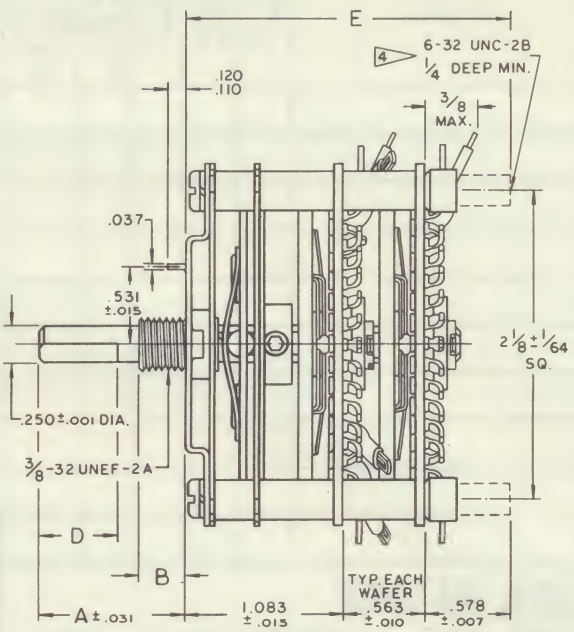
APPROVED _____ _____

CUSTOMER _____

PART NO. _____

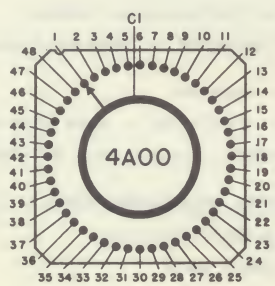
SHALLCROSS | SERIES 4 | ROTARY SWITCH SPECIFICATION SHEET #4 (MIL-S-3786 STYL

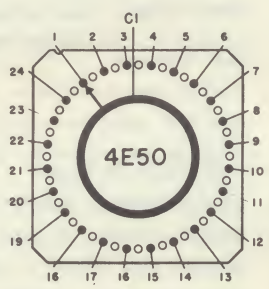


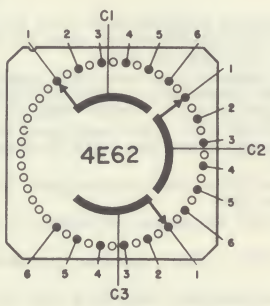


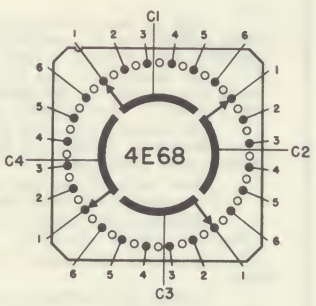
5 Standard dimension .218″ ±.005″ (optional dimensions available).

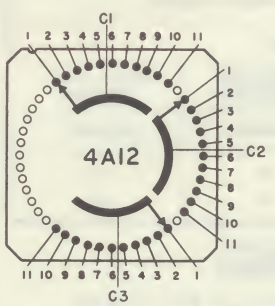
4 Rear support spacers and nylon cups are supplied (and included in E dimension) on 5 decks and over.

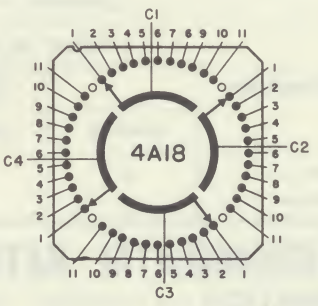












E SR15)

CUSTOMER'S ITEM NO.	SHALLCROSS PART NUMBER	ANGLE OF THROW	POSITIONS PER POLE	NUMBER OF DECKS	POLES PER DECK 1, 2, 3 OR 4	SHAFT LENGTH ▷2 DIM. "A"	BUSHING LENGTH ▷2 DIM. "B"	FLAT ANGLE ▷2 DIM. "C"	FLAT LENGTH ▷5 DIM. "D"	BACK PANEL DEPTH ▷4 DIM. "E"	INDICATE S (SHORTING) OR NS (NON SHORTING) FOR EACH DECK ▷3		GOLD PLATED CURRENT CARRYING PARTS		TERMINAL LOCATIONS
											S	NS	YES	NO	
-001															AS SHOWN AT LOWER LEFT FOR TYPE SPECIFIED
-002															
-003															
-004															
-005															
-006															
-007															
-008															
-009															
-010															

ELECTRICAL RATINGS

ROTATIONAL LIFE — 25,000 cycles per MIL-S-3786 test condition letter C ▷1

CIRCUIT VALUES FOR LIFE (ROTATIONAL) TEST				
	Inductive load (2.8 henries)		Resistive loads (a.c. or d.c.)	
	Milliamperes	Volts D.C.	Milliamperes	Volts
AT ATMOSPHERIC PRESSURE	50	30	500 50	30 300

CONTACT RESISTANCE

Initial and after vibration and shock ..... 5 milliohms
After moisture resistance and salt spray .. 5 milliohms
After life (rotational) tests ..... 10 milliohms

VOLTAGE BREAKDOWN

Initial ..... 1500 Volts RMS
End of life ..... 1000 Volts RMS

INSULATION RESISTANCE ..... Per MIL-S3786

MECHANICAL RATINGS

STOP STRENGTH — 50 inch-pounds minimum

ROTATIONAL TORQUE —

ROTATIONAL — TORQUE LIMITS			
	TORQUE (LB.-IN.)		
TEMPERATURE		5 SECTIONS AND LESS	OVER 5 TO 10 SECTIONS
	MINIMUM	MAXIMUM	MAXIMUM
Room	2	6	16
Minimum	2	8	20

ENVIRONMENTAL RATINGS

VIBRATION — 10-2000 cps per MIL-S-3786

ENVIRONMENTAL RATINGS

SALT SPRAY — 48 hours per MIL-S-3786
SHOCK — High Impact per MIL-S-3786
THERMAL SHOCK — Per MIL-S-3786
TEMPERATURE RANGE — −65°C to +125°C

MATERIALS

DETENT SPRING AND BALLS, SHAFT, MTG. PLATE, STOPS, BUSHING, MTG. HARDWARE, DETENT PLATE, BALL RETAINER, STOP PIN RETAINER, DETENT SPACERS — passivated stainless steel

WIPER ARMS — solid spring silver alloy (gold plate optional)

CONTACTS, COLLECTOR RINGS (Segments) — solid silver alloy (gold plate optional)

STATOR (DECK PLATE) — epoxy fiberglass

CONTACT LUGS (INTEGRAL WITH CONTACTS) — solid silver alloy

COMMON AND CORNER TERMINALS — copper alloy (tin dipped and teflon sleeve insulated)

ROTOR BEARING, ROTARY SPACERS, INSULATING CUPS — nylon

ROTOR — diallyl phthalate (glass fibre reinforced)

SCREWS AND STUDS — nickel plated brass

DECK SPACERS — steatite

ALL MATERIALS SUBJECT TO CHANGE WITHOUT NOTICE

NOTES

▷1 Life vs. load ratings apply for switches with up to 10 decks or 24 poles (whichever is greater). Life specifications must be derated for switches with greater number of decks or poles.

▷2 All dimensions are in inches unless otherwise specified. Tolerances are ±1/64″ for fractional dimensions, ±.005″ for decimal dimensions, and ±2° for angular specifications, unless otherwise specified.

▷3 All sections operated by one shaft must have same throw (indexing). Maximum number of positions for one shaft is determined by section with most poles.

▷4 Rear support spacers and nylon cups are supplied (and included in E dimension) on 5 decks and over.

▷5 Minimum flat length 3/16″. Maximum flat length = shaft length −(bushing length +3/32″).

▷6 Standard dimension .218″ ±.005″ (optional dimensions available).

7 Decks are numbered consecutively beginning with deck nearest detent assembly.

DRAWN _____ DATE _____
CHECKED _____ _____
APPROVED _____ _____

CUSTOMER _____
PART NO. _____

shallcross

CONTROL

REPRESENTATIVES

ALBUQUERQUE
Vinson Associates
P. O. Box 3295
Albuquerque, New Mexico
Phone: 505-298-7442

BOSTON
Forsberg Sales
125 Perkins Avenue
Brockton, Massachusetts
Phone: 617-522-6300
TWX: 710-345-0194

CHICAGO
Jay C. Angel and Company
2743 West Peterson Avenue
Chicago, Illinois 60645
Phone: 312-878-0653
TWX: 312-222-9040

CINCINNATI
A. C. Wahl and Associates
P. O. Box 15220
135 Williams Ave. Lockland
Cincinnati, Ohio
Phone: 513-821-3270
TWX: 513-577-1068

CLEVELAND
A. C. Wahl and Associates
24232 Maria Lane
North Olmsted, Ohio
Phone: 216-777-2899

CONNECTICUT
Forsberg Sales
P. O. Box 128
North Branford, Connecticut
Phone: 203-488-7995

DALLAS
The Gordon V. Peck Company
210 Casa Linda Plaza
P. O. Box 18627
Dallas 18, Texas
Phone: 214-328-3511
TWX: 214-899-8470

DAYTON
A. C. Wahl and Associates
2122 Marshon Avenue
Dayton, Ohio
Phone: 513-252-0961

DENVER
Vinson Associates
3600 South Lincoln
110 Tucker Building
Englewood, Colorado
Phone: 303-789-2203
TWX: 303-789-1649

DETROIT
L. T. Martenson
46 Ridge Road
Pleasant Ridge, Michigan
Phone: 313-543-3633

FLORIDA
Technical Marketing, Inc.
755 West Fairbanks Avenue
Winter Park, Florida
Phone: 305-647-6223
TWX: 305-647-0125

HOUSTON
The Gordon V. Peck Company
5757 Bellaire Boulevard
Houston 25, Texas
Phone: 713-664-1435
TWX: 713-571-2076

KANSAS
Thomas & Modrcin Assoc., Inc.
5450 Buena Vista Drive
Shawnee Mission, Kansas 66205
Phone: 913-432-2131

LOS ANGELES
Westec Electronic, Inc.
P. O. Box 781
El Segundo, California
Phone: 213-322-1561
TWX: 213-322-3394

MINNESOTA
Technical Associates Inc.
6121 Excelsior Blvd.
Minneapolis, Minnesota 55416
Phone: 612-929-6115

MISSOURI
Thomas & Modrcin
47 Village Square
Hazelwood, Missouri
Phone: 314-838-6446

NEW YORK
B. B. Taylor Corporation
2270 Grand Avenue
Baldwin, New York
Phone: 516-223-8000
TWX: 516-863-9878

NORTH CAROLINA
Technical Marketing, Inc.
1304 E. Wendover Ave.
P. O. Box 6664
Greensboro, North Carolina
Phone: 919-274-2570
TWX: 919-292-1113

PHILADELPHIA
Danco Corporation
Germantown Pike & Quarry
Hall Road
Fairview Village, Pennsylvania
Phone: 215-275-2600
TWX: 510-660-1979

PITTSBURGH
A. C. Wahl and Associates
113 Tillotson Circle
Pittsburgh, Pennsylvania 15237
Phone: 412-931-6700

ROCHESTER
T. Ferguson Sales, Inc.
P. O. Box 3893
228 Winton Road, North
Rochester 10, New York
Phone: 716-482-7757

SAN FRANCISCO
Westec Electronics
4117 El Camino Way
Palo Alto, California
Phone: 415-327-5850

SEATTLE
Jon B. Jolly
69 Marion Street
Seattle, Washington
Phone: 206-623-7060

ST. PETERSBURG
Technical Marketing, Inc.
755 West Fairbanks Avenue
Winter Park, Florida
Phone: 305-647-6223
TWX: 305-647-0125

SYRACUSE
Wulfetange-Ferguson Co.
129 Fiordon Rd.
DeWitt, New York
Phone: 315-GI6-3330

TULSA
The Gordon V. Peck Company
P. O. Box 15671
552 S. Allegheny
Tulsa 12, Oklahoma
Phone: 918-939-3047

CANADA
Aero Sales Engineering Co.
Div. of Garrett Mfg. Limited
4 Racine Road
Rexdale, Ontario, Canada
Phone: 416-249-9139

OVERSEAS

FRANCE
Spetelec
12 Rue le Chatelier
Paris, France
Phone: 425-05-23

JAPAN
Kyokuto Boeki Kaisha, Ltd.
C. P. O. Box 330
7th Floor, New Otemachi Bldg.
4, 2-chrome, Otemachi
Chiyoda - ku
Tokyo, Japan
Phone: 270-7711
TELEX No.: TK 2440

SWEDEN
Elektriska Instruments
Box 1237, Bromma 12
Lovasvagen 40-42, Ulvsunda
Stockholm C, Sweden
Phone: 26-27-20

SWITZERLAND
Baelocher ag
Foerrlibuckstrasse 110
Zuerich 5, Switzerland
Phone: 051-42-99-00

shallcross

CONTROL

DISTRIBUTORS

CALIFORNIA
Westec Distributing Co.
504 Main Street
El Segundo, California
Phone: 322-1561
Area Code: 213
TWX: 213-322-3394

ILLINOIS
Allied Electronics
100 North Western Avenue
Chicago, Illinois 60680
Phone: TA 9-9100
Area Code: 312
TWX: 312-431-1721

MASSACHUSETTS
Forsberg Electronic Distributors
125 Perkins Avenue
Brockton, Massachusetts 02402
Phone: 522-6300
Area Code: 617
TWX: 617-587-5467

NEW YORK
Taylor Electronics Corporation
2270 Grand Avenue
Baldwin, New York 11511
Phone: BA 3-8000
Area Code: 516
TWX: 516-868-9002

OHIO
Fastronic, Inc.
135 Williams Ave., Lockland
Cincinnati, Ohio 45215
Phone: 821-3270
Area Code: 513
TWX: 513-577-1068

PENNSYLVANIA
Samco Electronic Sales
P. O. Box 245
Fairview Village, Pennsylvania
19409
Phone: 275-2600
Area Code: 215
TWX: 510-660-1979

TEXAS
Southwest Electronics
3903-05 Richmond Avenue
Houston, Texas 77027
Phone: 666-2401
Area Code: 713

Beta Electronics, Inc.
Box 1001
Arlington, Texas
Phone: CR7-2231
Area Code 817
TWX 910-890-5115

SHALLCROSS MANUFACTURING COMPANY, PRESTON STREET, SELMA, NORTH CAROLINA 27576
TELEPHONE: 965-2341, AREA CODE: 919, TWX: 919-770-7839

LITHO IN U.S.A. 1966 W.P.CO.

shallcross

SUBSIDIARY OF **CUTLER-HAMMER**

SHALLCROSS MANUFACTURING COMPANY, SELMA, N.C.
ZIP CODE 27576 • TEL. 919 965-2341 • TWX 919 770-7839

THE SHALLCROSS LINE

PRECISION WIREWOUND RESISTORS

- Mil-R-93C Styles
- Hi Reliability Series
- Hi Precision Series
- Ceramic Bobbin Instrument Series
- Printed Circuit Series
- Subminiature Series
- Resistance Networks

ATTENUATORS

- Precision RF Attenuators
- Precision Audio Attenuators

PRECISION ROTARY SWITCHES

- Series 1 (1″) Rotary Switches
- Series 2 (1-3/4″) Rotary Switches
- Series 4 (2-1/2″) Rotary Switches
- 12,000 Series Oval Ceramic Switches
- Special Purpose Rotary Switches

INSTRUMENTS

- Resistance Decades
- Voltage Dividers
- Resistance Bridges
- Galvanometers
- Low Resistance Test Sets